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OF THE

NATIONAL FIRE PROTECTION ASSOCIATION

"To Promote the Science and Improve the Methods of Fire Protection and Prevention."

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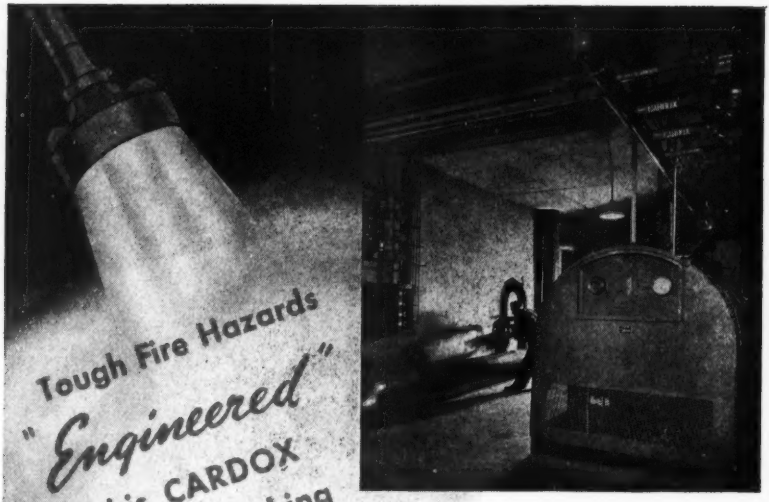

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Vol. 37 January, 1944 No. 3

QUARTERLY

OF THE

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A NON-PROFIT TECHNICAL AND EDUCATIONAL ORGANIZATION

To promote the science and improve the methods of fire protection and prevention.

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Table of Contents.

MAGNESIUM FIRE, DALLAS, TEXAS ..... FRONTISPIECE

FIRE PROTECTION DEVELOPMENTS IN 1943. *Percy Bugbee* 183

AIRPLANE CRASH FIRE FIGHTING. *Lt. George H. Tryon, III* 186

FISH CANNERY FIRE PROTECTION 201

AN ANALYSIS OF WATCHMAN FAILURE. *Melvin R. Freeman* 212

THE 1943 FIRE LOSSES 220

FIREMEN IN MILITARY SERVICE 220

MAINTAINING ELECTRICAL EQUIPMENT. *V. H. Tousley* 222

LARGE LOSS FIRES, 1943 225

Reports of fires appearing in the Quarterly are copies of or extracts from written reports forwarded to the Association. This Association, as a body, is not responsible for the statements or opinions of any of its members.

Plant of the Austin Bridge Co., near Dallas, Texas, burning on the night of December 15, 1943, with a loss of $550,000 (no insurance). Manufacturing magnesium incendiary bomb cases in a building of combustible construction, the hazard should have been obvious to anyone, but no effective action to safeguard the hazard was taken by any of the U. S. Government agencies concerned. *(International.)*

The Quarterly

Vol. 37 January, 1944 No. 3

Fire Protection Developments in 1943.

By Percy Bugbee,
General Manager, N.F.P.A.

The preliminary estimate for the fire loss in the United States in 1943 is $370,000,000. This is a substantial increase in loss over recent years, the comparable figure for 1942 being $310,000,000.

While during 1943 there were no fires of the magnitude of the Fall River rubber fire of 1941, or the *Normandie* or Cocoanut Grove fires of 1942, there were one hundred and five fires during the year involving a loss in excess of a quarter million dollars each, compared with 80 such fires in 1942 and a normal average of between 40 and 50 such fires. The increase in fire loss in 1943 was largely an increase in industrial losses. This trend was predicted a year ago. Some increase in industrial losses is almost inevitable at a time of all-out war production because of the great increase in values and in fire hazards at a time of intense production. There is some comfort in the fact that the increase in industrial fire losses has not been at as rapid a rate as the increase in industrial production.

A noticeable trend in the latter part of 1943 was a very substantial number of serious fires in food plants. Sufficient grain and other important war foodstuffs were destroyed in these fires to feed several good-sized armies.

For several years the trend in farm fire losses has been downward. That downward trend was halted and the farm loss in 1943 showed a slight up trend. So far as early information reveals, the dwelling loss trend continued slightly downward during the year.

Perhaps more important a factor than has been generally realized in the increase in fire loss was the negative attitude of the War Production Board towards the granting of priorities for fire protection equipment for important industrial and other buildings. That negative attitude was modified in the fall of 1943 and during the coming year it is quite likely that badly needed fire protection equipment will be permitted and even encouraged. A favorable factor in developments of 1943 which will have a long-time benefit has been the great increase in the number of industrial fire brigades properly trained and properly equipped. This development was not only fostered by industry itself, but by inspectors from the War and Navy Departments, the Office of Civilian Defense, and similar agencies. The first complete manual on the organization and training of industrial fire brigades ever to be issued was published early in the year by the National Fire Protection Association.

The fire departments of the country faced during 1943 some very serious problems. A national survey of paid fire departments in cities over 20,000 population made by the N.F.P.A. in November

but no effective action to safeguard the hazard was taken by any of the

revealed that these departments had already lost one out of eight of their experienced men to the armed forces, and it seemed apparent that as the drafting of married men proceeded the fire departments might face further serious inroads into their effective strength. The average citizen may not have noticed that the fire trucks responding to fires were manned with two or three men instead of the usual five or six. Inadequate manning of municipal fire companies was undoubtedly a factor in the increase in big fires during the year. With private fire protection restricted or denied, and public fire protection weakened, it is small wonder that the fire loss substantially increased. Obviously fire crews that fall far below the usual schedules for manpower cannot be expected to give adequate service at fires which require the prompt use of numerous hose streams, large-scale ladder operations, etc. It is likely that during the coming year fire department officials will be faced with the necessity of taking various drastic and unusual steps to keep fire department manning up to at least a reasonable minimum.

The average age of fire fighters in some departments has risen to an alarming degree. In a number of cities the age limit restrictions have been removed and it seems probable that pension costs in many communities because of this increase in average age will be a serious post-war municipal problem.

Not only did the draft deplete the manpower of fire departments, but many men were induced to take more lucrative positions as fire chiefs and firemen in war industries. Rates of compensation for firemen have not been adequately adjusted to compete with war industries and in most communities the hours of duty for firemen are excessive, as compared with almost any other occupation, including police departments in the same communities.

The fire departments in general had another war-time problem to contend with with respect to the maintenance of adequate apparatus, hose and other equipment. During the depression years almost every city curtailed its purchases of major fire equipment. A survey made by the N.F.P.A. in 1941 showed that at that time nearly 52% of the municipal fire apparatus in the cities of more than 25,000 population was obsolescent by reason of age. Since the outbreak of the war, most fire apparatus has been taken by the Army and Navy and very little has been allowed for municipal use, so it is likely now that the obsolescence approaches 60%. It has been customary to consider as obsolete all apparatus having more than 15 years of service, although such apparatus is commonly considered useful as reserve equipment if properly reconditioned. Much of the present apparatus is a good deal older and has seen even 20 or 25 years of service. Another problem has been the difficulty experienced by many fire departments in getting parts for necessary repairs of apparatus damaged by accidents or breakdowns.

A good many persons have wondered why the thousands of units of auxiliary fire equipment distributed under the civilian defense program were not an effective substitute for some of this over-age and obsolete municipal fire apparatus. It should be remembered that this equipment was designed for emergency equipment for use of auxiliary firemen. None of it was provided on standard fire department motor chassis or other suitable truck chassis and each city was expected to find some means of conveying the auxiliary pumps, hose and appliances in the event of an emergency. It is interesting to note that many cities have failed to make any use at all of this auxiliary fire equipment, which is well designed and useful equipment for many purposes.

With the progress of the war and the inevitable decline in interest in civilian defense, there has been a considerable decrease in the ranks of auxiliary firemen, and the OCD program for fire guards announced in September, 1943, while excellently conceived, has not taken a real hold as it might have if conditions had been different. It is in many ways unfortunate that the thousands of civilian defense workers in the fire program will for the most part lose interest and disappear from the scene.

Many fire authorities in this country have been watching with great interest the development of the federal fire service in

England brought about because of the serious fire problems encountered during the blitz period. It appears that this service has operated quite satisfactorily in England, but there is no indication that a similar proposal would be welcomed in this country and there appears to be no need for any federal fire service in America. The British experience does indicate quite clearly, however, that better methods of coördinating fire department activities to embrace larger areas would be worth continued and more intelligent study in our own country.

Because of the war, general interest in fire protection and prevention has grown rapidly and a greatly increased demand for standards of fire protection has been created. The National Fire Protection Association issued early in 1943 the National Fire Codes for Extinguishing and Alarm Equipment, embracing a compilation of 42 standards in that field and the National Fire Codes for the Prevention of Dust Explosions covering 14 standards. In the fall of 1943 the National Fire Codes for Flammable Liquids, Gases, Chemicals and Explosives were issued, embracing 44 standards in this field, and early in 1944 the National Fire Codes for Building Construction will appear, so that some 150 fire standards will be available in four volumes.

Because of the Cocoanut Grove disaster in Boston late in 1942, there has been a tremendous interest in legislation for the safety of places of public assembly, and numerous cities have adopted municipal ordinances covering night clubs, theatres, halls, churches and similar types of places where people congregate. Both the National Fire Protection Association and the National Board of Fire Underwriters issued suggested ordinances in this field. The National Building Exits Code of the N.F.P.A. is the basic standard for life safety in public buildings.

In the 1942 contest for year-round excellence in fire prevention activity conducted by the National Fire Waste Council of the United States Chamber of Commerce, Milwaukee, Wisconsin, emerged as the winner and in the 1943 Fire Prevention Week contest conducted by the N.F.P.A., Chicago came out on top of more than 1800 cities reporting. It was apparent that Fire Prevention Week in October of 1943 was more widely observed throughout the United States and Canada than ever before in its long history.

An item of growing importance to many municipalities has been a material increase in the number of airplane crash fires and the difficult problems involved in setting up any procedures to effectively control this type of fire. Early in 1944 a conference called jointly by the National Fire Protection Association and the Army Air Force will meet to discuss this problem in all its angles and it is hoped that some specific procedures may be evolved.

As in other fields, those concerned with fire administration are giving thought to measures of post war planning. Following the war there will be many serious fire protection problems to be solved. Municipal fire departments must be strengthened once more and standards for fire protection equipment must be promptly restored. The intelligent distribution and use of the thousands of pieces of fire apparatus built for various federal agencies is a problem of major importance.

Students of building construction and city planning all agree that if our country had been subjected to the type of fire attack that Britain and Germany have been subjected to much more appalling damage and destruction might have been inevitable. The gradual rebuilding of American cities to make them immune to the dangers of sweeping fires and conflagrations is a long range planning problem of the utmost importance to the future welfare of our country. Only by long range planning and reconstruction of our cities in times of peace can we have any assurance of maintaining the existence of these cities in any future war.

Airplane Crash Fire Fighting.

By Lt. George H. Tryon, III.

As the aircraft has eliminated boundaries and made the world an air base, so they crash with no regard to location. The Army Air Forces have been greatly concerned with the problem of fighting fire as a result of forced landings and crashes, devoting much time and effort to limiting loss and saving personnel. Experience has taught us much, but still there are no "experts." Any article attempting to deal with this subject must, by necessity, clearly emphasize and reflect that efforts to cope with crash fires are still in the experimental stages.

It is also important that such knowledge as has been gained be passed on to civilian fire fighting forces. These forces are as greatly concerned with the problem as Army officials, and the Air Forces realize that it will profit from the sharing of information only in the degree in which it aids in providing it.

While the theory that ever increasing air activity means an increase in crashes is not accepted, it cannot be ignored that this is a possibility; as men interested in anticipating fire potentials, this approach gives purpose to a study of methods to be employed in extinguishment.

Response to Crash Fires.

Many factors enter into the problem of crash fire fighting, but most of them are common to ordinary Fire Department operations. First consideration is the time element. It is vital to catch the fire at incipiency for several reasons. First of all, large quantities of fuel (gasoline) constitute a severe hazard — so severe that once any appreciable quantity becomes ignited, the fire fighting forces must assume a defensive rôle due to heat generated and collapse of airplane structures and "skin." Personnel are quickly trapped with the jamming of escape hatches and the rapid spread of fire. Immediate response alone will permit successful rescue operations.

To accomplish this, a high degree of planning is essential and ordinary reporting methods have to be supplemented. Aircraft crashing in outlying regions, timberland, or farm country are particularly difficult to "spot." The Army Air Forces has developed a grid-map system to provide an accurate location guide at almost all stations. Azimuth charts may provide an alternate method for "spotting" and may be more accurate if personnel using them are fully schooled in the procedure to be employed. For ordinary work, the grid system lends itself to adaptability with a minimum of instruction.

Civilian fire fighting agencies should establish a network of communication which will embrace an area consistent with maximum effectiveness and in collaboration with neighboring municipal agencies and Army Air Bases. The coördination of fire department activities over wide areas through mutual aid plans or other arrangements for the coördinated activity of a number of fire departments seems essential for the effective handling of airplane crash fires. However, despite prearrangement of coverage responsibility, the system will collapse if the communication network is not established to report incidents. Normal fire-box alarm systems do not exist beyond strict city limits. Telephones must be relied upon to fill the gap. Telephone reporting, never satisfactory because of the human element involved, must be braced by systematic employment of spotters. Your spotters should be furnished with grid maps and given specific

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This article has been prepared for the National Fire Protection Association by Lt. Tryon of the Office of the Intelligence Officer and Provost Marshal, Headquarters, Air Service Command, Patterson Field, Fairfield, Ohio. Its purpose is to provide municipal fire departments with the experience of this Command in fighting airplane crash fires, with the idea in mind that by sharing and pooling of the experience and techniques illustrated, those departments might be in a better position to aid in the new problems brought about as a result of aircraft accidents. Comments regarding the material presented are solicited, and request is made that correspondence be directed through the N.F.P.A. for the attention of the office indicated above.

instructions in their use. Corner storekeepers, farmers, state patrolmen, forest rangers, and other rural residents should be approached for this service. Past experience has clearly indicated that their coöperation is willing and effective. If any difficulty is encountered, they may be sold on the self-preservation of their personal property liable to damage in airplane crashes.

Wherever possible, two-way radio equipment in crash trucks or command cars facilitates response and permits reporting in case of unexpected difficulties encountered. Instructions as to location originally received may be supplemented with details as further reports are transmitted. If this can be flashed to the responding units, much time may be saved. Crashes in fields or woods may present physical difficulties not originally anticipated. Radio communication might well be vital in overcoming them. Trucks bogging down has been a constant hazard, especially with standard equipment designed for smooth riding on concrete or macadam. One specific example is fresh in mind, where the need for a portable pumping unit in a heavily timbered section was acute but unavailable for over an hour because a unit was forced to make a return trip for the equipment. The fire spread viciously in the intervening time.

Essential in this whole communication picture is, to use an Army word, correlation. According to a survey a large majority of the crashes, estimated at 75%, occurred within a radius of 16 miles from an established Air Force Flying Field during 1942. Municipal fire departments must constantly bear in mind that army officials be notified IMMEDIATELY. This is not merely to bring fire fighting assistance to the crash, but also technical assistance. It must be appreciated that the military aircraft is today a highly complex weapon which has distinct and individual fire hazards, with which A.A.F. Engineering Officers are alone fully familiar. We will take up some details of this later in the article, but calling in Army assistance at first notice may EASILY SAVE LIVES. Thus another communication feature — have at your switchboard NAMES and NUMBERS of proper individuals to be notified at the nearest Army, Navy, Coast Guard, Civilian Air Patrol or Municipal Airport so that no time will be lost in this vital matter.

International.

Wreckage of a pre-war plane that crashed and burned in a wooded area after the pilot bailed out near Imperial, Penn.

Life Is at Stake.

It should be assumed that in every crash, life is at stake. Bail-outs are not frequent, for crashes are a result of sudden airborne difficulties or accidents which permit little chance of escape. Anticipated accidents are as rare in the air as they are in an automobile. Anticipated mechanical defects in the air are critical in a degree which gives safety engineers gray hair overnight. Assuming life is at stake, certain additional considerations are in order. Ambulance response must be prearranged; crash tools immediately available; first-aid appliances on hand — enough for crews as high as ten to twelve, particularly splints and burn treatments. Tow chains are often essential, since it is frequently necessary to alter the position of sections or the whole aircraft to facilitate fire fighting operations. If this is done, however, great care must be exercised, for the moving might easily cause fuel tank rupture, friction sparks capable of igniting flammable vapors, or breaking of an electric wire, causing sparks. It should be done only under the direction of experienced and qualified personnel or as an emergency measure where no other course of action offers any possibility of success.

Acme.

A P-38 on taking off crashed into the side of a hangar at the Lockheed Air Terminal, Burbank, California, September 30, 1942. Due to prompt work by the Lockheed-Vega firemen and the Burbank Fire Department, the fire was controlled without extensive damage to the hangar, using largely fog equipment. The pilot lost his life and several men were injured.

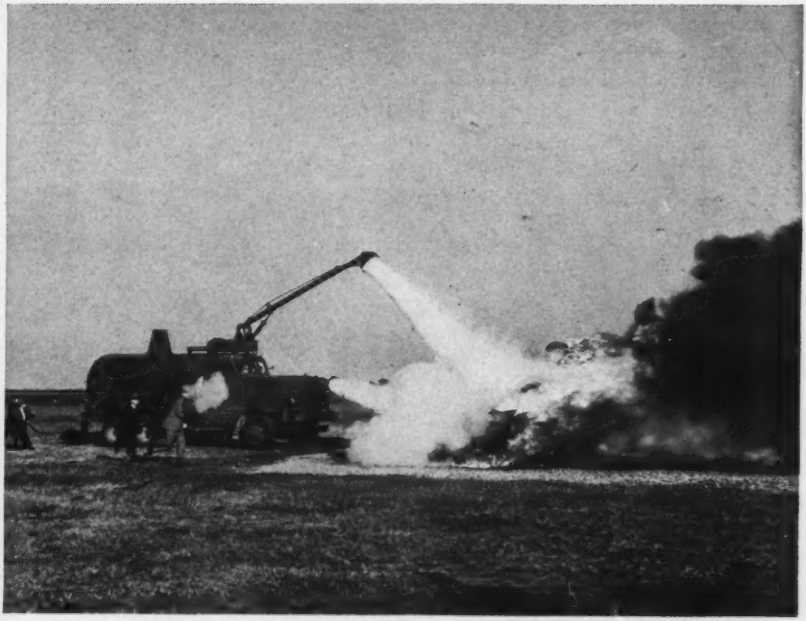
Approaching a Crash Fire.

We are coming upon a bomber fire. It is observed that fire has started in the engines and has not spread to the wing or fuselage sections which contain the main, auxiliary, and reserve fuel tanks. Wind direction must be first noted, as it plays the same important rôle that it does in any major building fire in congested areas, although here more important because spread to fuel tanks will result in immediate total loss of ship and personnel under most circumstances and the distance to the danger zone is measured in inches rather than feet or yards. Fire equipment must approach with a well-defined plan to the windward and in position to accomplish the first two primary missions unless it is positively known that the first is not necessary:

1. To rescue trapped personnel.
2. To sweep the fire away from the vulnerable spots.

In other words — arrive to go into action immediately to gain access to the cabin of the ship, of whatever design, and secondly to apply lines or extinguishers in a direction which will facilitate extinguishment by preventing the ignition of additional supplies of fuel (gasoline).

Where the fire is apparently on the wing tips, it can be beaten back away from the fuselage or body without engulfing the fuel tanks, providing the fire is hit quickly and from the correct direction. Wing tip fires are usually electrical in origin and should be treated as such up to the point of logic, but while in source electrical, the fire is also Class A in most cases and this makes possible use of normal agents more available, namely, water or water fog. Again, while extinguishment is essential, pilot and crew rescue has first priority and at least a portion of the fire fighting crew should concentrate on this task immediately.



An Army Air Force crash truck discharging carbon dioxide through both overhead boom and bumper nozzles.

An Army Air Force crash truck using high pressure water spray.

International.

Two Navy planes crashed at East Braintree, Mass., on March 4, 1939. One fell on the dwelling shown in this picture, but due to prompt work by firemen, the damage to the dwelling was limited to $2000, and spread of fire to other buildings was prevented. The plane first hit in the street (dark spot in road in front of corner of burning dwelling.)

Many, too many, times, the fire has spread to the whole aircraft before arrival of crash equipment. In such cases prompt action is even more essential, with the sole concentration on saving life. Approach must be predicated on this primary task and while crews are drawing lines, two fire fighters should equip themselves with asbestos suits to enter the cabin wherever possible. It is unlikely that any ship more than half involved in fire can possibly be saved and while it represents many thousands of the taxpayers' dollars, their investment in the crew is above such a measure. New Army crash trucks with overhead boom nozzles and bumper sweeps have been designed for quickest entry, with the accent on speed and accessibility to the involved ship primary. This same objective must be applied in all cases despite limitations in equipment. It is recognized that certain crashes preclude all attempts at rescue despite every intention and in such cases the frustration is as sickening as it is real.

Other matters must be considered in the approach. The A.A.F. has discovered that the main barrier to effective fire fighting in airplane crash fires is an insufficiency of extinguishing agents, and number one on the list is, of course, water. Carrying sufficient water in mobile units has not been the answer in all cases, although more and more Bases are being equipped with auxiliary water tank trucks with capacities ranging from 1000 to 1200 gallons. These must be auxiliary and not included in the normal crash unit due to weight considerations and the sacrifice in mobility and speed. Many of these units have been built out of scrap equipment or old fuel servicing units, with pumping units, hose, nozzles and foam generators added.

Firemen trained to note water supply sources will do well to look for them in crash fire calls. A relay system employing available pumpers, and portable units has been successful and is especially valuable for foam generating systems. Where adequate equipment is available, locating pumpers at hydrants and reservoirs during initial stages while a forward unit is expending its tank supply, makes for water sufficiency which would not otherwise exist. One Base employs this technique in the following way which is given as an illustration of the method:

Three Company Foam Generator System.

(For the Extinguishment of Aircraft Crash Fires —Sacramento Air Service Command, McClellan Field, Sacramento, California.)

Upon receipt of a crash alarm, the three (3) pieces of fire apparatus making up the foam system will go into action as follows:

(1) One 500 g.p.m. pumper, equipped with a foam general complement, will proceed to the scene of the aircraft fire.

(2) One 750 g.p.m. pumper will proceed to the hydrant nearest the crash.

(3) One 3000-foot capacity hose truck will proceed to the hydrant taken by the 750 g.p.m. pumper.

The 500 pumper will set up the foam making equipment and start pumping operations by using the water from its booster tank (140-gallon capacity). This pumper is fitted with 2½-in. gate valve on the suction side of the pump, so that when a line is laid by the hose truck from the 750 pumper the line may be connected to the suction side of the 500 pumper without shutting down. As soon as the supply line is charged, the 2½-in. gate valve may be opened and the booster tank valve closed.

The pressure at the foam generator shall be maintained as near 90 pounds as possible.

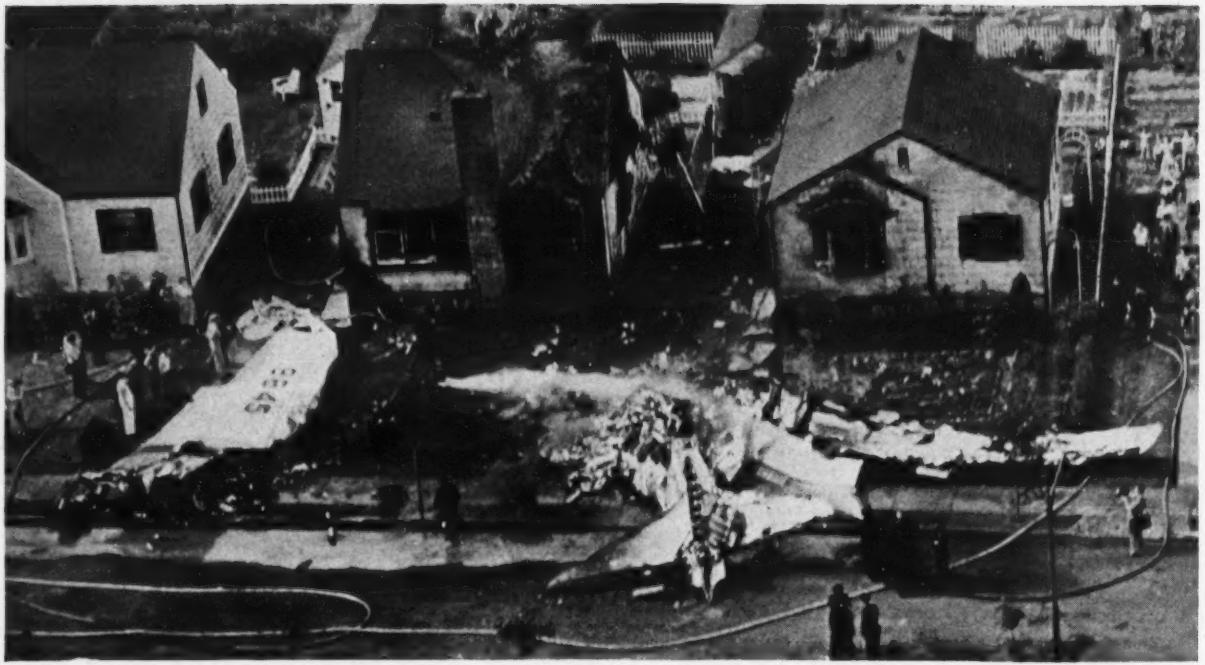
The foam generator equipment is fitted with a 2½-in. siamese, so that as short lead was made from the 750 pumper the supply line could be attached to the foam generator directly and the 500 pumper could be disconnected and start stretching a fog line from the fire to a hydrant, thereby using this pumper for two distinct operations.

The hose truck, besides carrying 3000 ft. of 2½-in. hose, also carries forty 50-pound cans of foam powder, which will make approximately 24,000 gallons of foam.

This truck, upon removing all the foam from its bed, will proceed to the main fire station and load up additional foam powder.

Meanwhile, as the foam generator equipment is being set up, all ½-ton trucks from the Motor Pool will be loading up with foam cans and will have proceeded to the scene of the aircraft fire before the hose truck has completed laying its hose line.

This type of approach is based on a guarantee that adequate units are available, which might not be realistic for some Civilian and Air Field Departments. It does call for prior planning. We will discuss the use of foam as an extinguishing agent in a later section.



International.

A mid-air collision and subsequent crash of two Army bombers in an outlying section of New York City on June 17, 1940, cost the lives of eleven army flyers and a housewife, who was trapped in her home as burning gasoline ignited seven houses on two streets in which the planes crashed. Twenty-two fire alarm boxes over a square mile area were operated by excited citizens, and countless telephone calls swamped the fire department switchboard.

Bombs and Ammunition.

Always consider that the military aircraft carries ammunition, bombs, pyrotechnics, destructors, and incendiaries. In continental United States, especially near our Training Bases, this assumption is not unwarranted and in addition many test and tactical flights are made, especially near Modification Centers and along the Coasts, Atlantic, Pacific, and Gulf. The additional hazard is not to be treated lightly, and it may be a psychological barrier to effective action. Some misunderstanding has shown itself in this matter and it is known that in one case instructions were issued that civilian fire departments were not permitted within 1000 feet of a crashed aircraft. Of course, such a regulation is not sensible. Entirely apart from the crash fire itself, lives and property must be protected and the history of American Fire Departments reflects that lives and property are protected despite the risk involved. Ammunition discharged due to excessive heat has a range of usually not over 200 yards, but the flying bullets and shell cases are relatively light. Not being projected, it lacks both normal force and direction. Shells might burst in any direction. As in other fire department operations, danger is involved, but where ammunition is alone concerned this danger should not be overemphasized.

Bombs are another matter. Where more than one is encountered they may be expected to explode all at one time when subjected to intense heat. There are roughly four categories of aircraft bombs, namely:

1. Practice bombs.
2. Fragmentation bombs.
3. Demolition bombs.
4. Chemical bombs.

The practice bombs may only be considered in a separate fire hazard class when in storage, as at that time they are without their charges. When in aircraft and involved in crashes they should be treated with the same respect given to the other three classes.

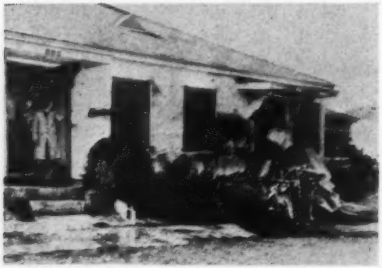
Fragmentation bombs have approximately 15% TNT or Amatol, which is considerably less charge than is found in the demolition bombs. These are not liable to detonate in mass but intermittently, although this knowledge is small comfort to fire fighters. Demolition bombs contain slightly more than 50% of their weight of explosives and the new light case bombs contain as high as 77%. Detonation produces a vast amount of "blast," the destructive qualities of which increase with the amount of explosive in the bomb body. Metal fragments scatter at great distances and high velocity, and no attempt can be made to fight fires involving these bombs, but efforts confined to prevent the spread. Fire fighters must retire to at least 1000 feet and utilize available cover in the same way as they would in case of a bombing attack from the air. Chemical bombs present a separate and distinct hazard because of the toxic quality of many of their contents. Inasmuch as it is not contemplated that aircraft within the continental United States will carry such bombs, no details as to fighting such fires are necessary in this article. The carrying of incendiaries is likewise not anticipated, but if encountered in some rare instance should be treated in the same way that magnesium, thermit, or thickened gasoline fires might be fought.

Destructors are carried on many military aircraft for the purpose of destroying secret and confidential equipment in case of a crash or forced landing. From the fire hazard viewpoint there is little to worry about, as the missiles are very light and have a limited range. If entry into the aircraft has been gained, only experienced personnel should endeavor to remove the equipment or destructors.

In making your approach to a crash fire with several pieces of equipment, it is important to group that equipment so that compatible extinguishing agents are massed for the operations. In other words, do not break down a foam blanket by the use of water fog or high pressure water streams. On the other hand, carbon dioxide and foam may be used together, with the CO_2 penetrating places which foam fails to reach and the foam used to cover exposed surfaces. Prior thinking in the arrangement of the equipment will forestall shifting during the critical period.

Speed in approach is largely governed by terrain. This article, written for civilian fire agencies, does not anticipate response

during the actual forced landing where the question of equalizing the speed of the aircraft, approximately 100 miles per hour, is a vital matter. A.A.F. Air Base Departments are schooled to anticipate crashes by familiarizing themselves with landing procedures and airborne characteristics of the various types of aircraft using the particular field. Crash houses located on flight lines are valuable only when the crews are on constant alert and



International.

Wreckage of a P-38 which crashed in Burbank, California, December 22, 1943. The plane knocked off part of the roof of a church and came to rest between two houses, where it burst into flames. The fire was extinguished before any extensive damage was done to surrounding homes.

are trained in observation of field activities. For such alarms getting a head start is a vital matter which municipal departments will not be concerned with unless sufficient personnel exist and flying activities dictate the advisability of erecting a watch tower for the exclusive purpose of observing crashes.

Escape Hatches.

A final consideration in the matter of approach is to place crews in a position to operate the escape hatches provided in the particular aircraft. While few generalities as to the location of these hatches are permissible due to the variance in design, it may be said that almost all military aircraft have quick releasing devices on the hinges of cabin and cockpit doors. Many of these are operated by the breaking of small glass windows and reaching up or to the side for the emergency latches on the inside of the ship. Hatches operate in somewhat the same manner, and care must be taken that the hatch door itself does not fall to the inside, injuring personnel. Other points of egress for the crews may be found at bombays, canopies, plexiglas compartments, and, in some cases, at the openings created by the lowering of the front wheels in the tricycle type landing gear assembly. Without the expert advices of crew members or Air Force representatives, cutting of skin surfaces is not advised. While such a method can be used, without proper knowledge of the location of electrical systems, gas lines, and oxygen and carbon dioxide tubings, it is dangerous due to the obvious increase in the fire hazards.

Extinguishing Agents.

Airplane crash fire fighting would be simpler if we could rule out all but a single agent that might be exclusively used for extinguishment. This simply cannot be done. A.A.F. stations are being supplied currently with high pressure fog, foam, and carbon dioxide crash equipment. They are being instructed to respond to alarms with all units of each type available, consistent with normal protective requirements of a second simultaneous fire. Out of the experience to this date, certain conclusions might be drawn as to the employment of each of these agencies, although it is both impossible and impracticable to favor one over the other.

Carbon dioxide has proved to be the quickest agent in extinguishment. However, speed is not the only norm by which we should judge the relative values of the different methods. Carbon dioxide will knock a flame down, and in confined spaces, such as engine nacelles or cabin or cargo enclosures, is effective in every sense of the word, providing sufficient quantities are on hand to eliminate flashback. Fires resulting from accumulation of gasoline vapors in wing sections have also been successfully extinguished with carbon dioxide. A warning in its use is to avoid directing discharge into the face of personnel or to create such a high concentration of the gas in an enclosed cabin so as to reduce oxygen content below normal breathing requirements. One of the newest pieces of crash equipment that has been built for the A.A.F. carries 6000 pounds

Acme.

Thirty-two lives were lost when a four-motored bomber crashed into the fourth story of a meat packing plant in Seattle on February 18, 1943. Parts of the wreckage of the plane, where it crashed through the roof, may be seen in the foreground.

of carbon dioxide and 500 gallons of water discharged through an overhead boom, radiator or front nozzle, and side hand lines. These trucks, weighing 42,000 pounds, have liquid carbon dioxide under low pressure held at a temperature of 0° F. The new models are also equipped with a "water javelin" (a long pipe with a spearhead filled with holes), which may be rammed through the plane to direct a water spray around the crew until rescue can be effected. Municipal departments not having such equipment must rely upon normal carbon dioxide supplied in 50 lb. cylinders, perhaps manifold in groups of 4 or 6. Such a quantity is of little value in extinguishing fires that have spread to main sections of the fuselage and wing, but may be used to aid in rescue work where quick and temporary extinguishment of local areas is the primary requirement. Carbon dioxide is the quickest extinguishing agent available for gasoline fires, has the difficulty of usually being in insufficient quantities to handle large conflagrations, has the inherent danger of flashback, which must be closely guarded against, and is an excellent companion to other methods employed.

Foam has the reputation of being slow but sure. A well-organized foam generating system has been most successfully used in crash fires. However, it is wholly dependent upon adequate water supplies. Booster tanks on standard pumping units and crash trucks do not provide sufficient quantities for the more serious crashes. Auxiliary water tank trucks or hydrant connections are therefore very essential. Of the different kinds of foam, chemical and mechanical, most success to date has been with the latter. A good heavy quality is the most essential characteristic of foam used for airplane crash fire fighting, as it must adhere to vertical surfaces to complete its smothering mission. Foam may be applied to all surfaces, but is not especially suitable for paving the way in rescue work. Fires in the engine sections that have not spread are more aptly handled with carbon dioxide. Fires involving wing and fuselage sections which have not

involved the gasoline tanks are normally better handled with foam. Where foam is used it should be done to the exclusion of water fog or high pressure water streams. Spillovers of gasoline on ground surfaces may be extinguished promptly with foam properly applied. Used in conjunction with carbon dioxide, the two supplement each other, giving complete coverage and effective results.

Water fog is the new darling of fire fighters and actual crash case records clearly indicate success in its use. The chief difficulty experienced to date is again the matter of sufficiency. A second experimental development of the Corps of Engineers in mobile crash equipment has been a thousand gallon unit, mounting turret nozzles for discharge of between 250 and 300 gallons of water per minute at 600 pounds pressure. Three hand lines are provided. The unit has been field tested and has performed most successfully. Civilian fire departments not having such a large unit will be handicapped unless they possess auxiliary water tank trucks, or the particular situation permits tying in with municipal water supplies. Water fog used in conjunction with carbon dioxide has proved effective. Water fog is an excellent protection for personnel performing rescue work. Where the wreckage is complete, it may be used if sufficient quantities are available. In some cases fog has been used as the primary agent and foam secondary for final extinguishment (not simultaneous). Water fog will penetrate almost as well as carbon dioxide and its cooling effect is well established.

Some experience has been recorded with the use of high pressure water streams, and this method may be the only one available to certain fire departments. As in all cases when used on flammable liquids, high pressure water streams may result in spread of the fire. Also, such streams may cause magnesium materials employed on aircraft to explode rather violently. Cases have been recorded where fires in engine compartments have been chased from one side to the other without effecting extinguishment when "blast" streams were used, but other cases indicate that high pressure lines have been solely responsible for the rescue of the occupants of the plane when used to cut a path through flaming gasoline to make rescue possible.

Thus, it can be seen that all these agents have their place in crash fire fighting. Attempts to legislate which should be used must result in failure. Each has its function and place, whether used singly or in conjunction with another. The problem of adequacy is basic. Solution of this problem is neither simple nor easily solved. The choice is clearly between the following:

1. Increasing the size, and consequently the weight, of present mobile crash trucks.
2. Providing auxiliaries, such as water tank trucks, foam trucks or trailers, or bulk CO_2 tank trucks.
3. Enlargement of water systems with flush type hydrants (especially subterranean grid systems on the airport proper).

Mobility is such a feature, that the first choice is made difficult. We want more, but we also want speed, maneuverability, and lightness. More small units packing a big wallop will be more suitable. Auxiliaries are definitely in order. They can act as the strategic reserve source, not expected at the early phase, but as reinforcements for the tactical battle wagons. More adequate water grid systems must be regarded as desirable post-war projects.

Crash Tools.

Crash tools are vitally important items, especially for rescue work. Fire Department personnel at Army Air Bases who have the opportunity to study and observe aircraft structures and maintenance procedures have an advantage over the civilian departments who necessarily will not be as familiar with technical features. What an Air Base Department will be able to do with a screw driver, perhaps a municipal department must do with a wrecking bar or chisel.

Crash trucks today are provided with fire axes, gooseneck wrecking bar, an offset wrecking bar, hacksaw and blades, a cold chisel, bolt clipper, pipe cutter, machinist's hammer, a hunter's hatchet, 4 linoleum 3-in. folding blade knives, lineman's pliers, blacksmith's sledge, tinner's

International.

An Army fighter plane out of control crashed in Daly City, California, December 5, 1943. Flaming wreckage ignited half a dozen houses. Fortunately the house which the plane hit was vacant at the time. Further spread of fire was prevented by local fire fighters. The pilot was killed, but no others were injured despite exploding machine gun bullets.

snips, flashlight and grappling hook assembly. These tools are the standard equipment and all have their place in crash rescue work.

In addition to these standard items, several new gadgets have been developed, including a parachute knife which has a 7-in. blade, a blunt, slightly hooked end which makes it impossible to cut the individual it is desired to free, and a leather wrist loop which keeps the tool continually at hand even though it is necessary momentarily to use both hands in the operations. In one crash it would have been impossible to remove an injured pilot without cutting the parachute harness. With the use of this rescue knife the harness and safety strap were severed in a few seconds and the injured man removed from the flaming airplane to an ambulance and safety. Another tool which has been developed is a special type of axe which has a wide flange behind the cutting edge so that metal surfaces may be cut without binding of the axe as would result with the normal axe.

Asbestos Suits.

Asbestos suits, perhaps not classified strictly as a tool, are another vital piece of equipment for this work. At the present time there is a great deal of uncertainty as to the suitability of the present style asbestos suit which has caused serious burns especially when improperly and hastily donned. The Corps of Engineers is working on an improved model at the present time. Some departments advocate the use of asbestos gloves and hoods without the cumbersome body protection. Another question of importance is when this suit should be put on, but this would vary with each crash fire to a certain degree. The Corps of Engineers is known to be advocating that the operator of the turret nozzles on the water fog truck, described above, be fully covered with asbestos protection before arrival at the scene. This requires that two of the crash crew on the line have a suit at least partly on during their alert shift. It is unsafe to attempt donning this equipment while en route to the fire. Of course, for rescue work in the fuselage, an asbestos suit is a necessity.

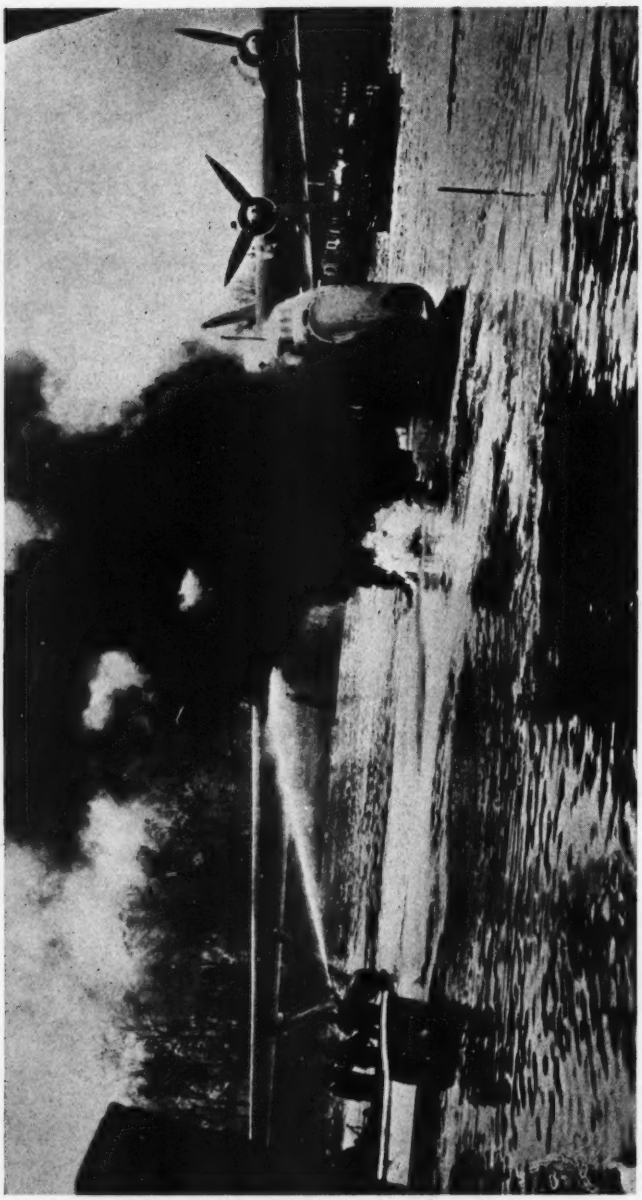
Aircraft Fire Hazards.

Military airplanes of today are highly complex machines and from a fire hazard viewpoint may be broken down into 7 categories:

1. Engine.
2. Fuel, Oil, and Hydraulic Systems.
3. Electrical Systems.
4. Oxygen System.
5. Anti-icing and De-icing Systems.
6. Armament.
7. Cargo and Cabin.

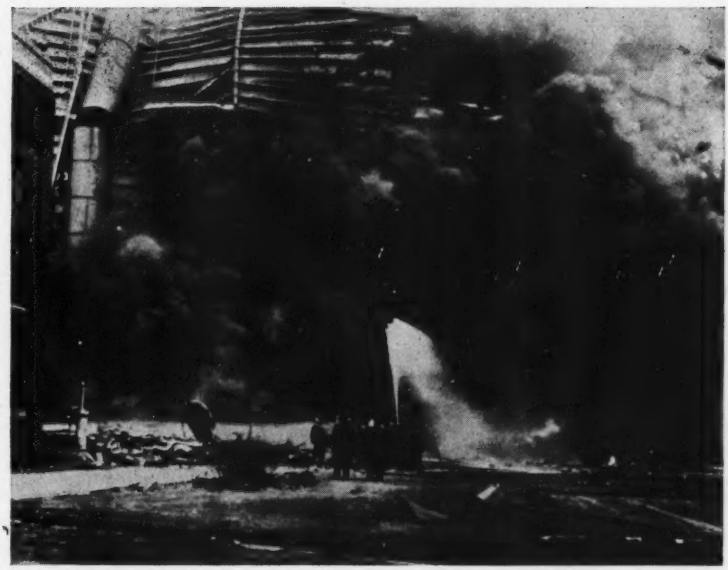
A word about each of these is in order, but in an article of this type going into detail would be impossible unless we took into consideration the many types and peculiarities of individual ships.

The largest perpetrator of fires, according to the experience recorded by this office to date, has been the engine and nacelle sections. These are in origin largely fuel, oil, and electrical fires and might be called common to any power plant. The chief sources are carburetors, fuel lines, exhausts, distributors, spark plugs, and miscellaneous electrical wiring. The largest percentage are caused by



International.

Fire in a flying boat being tested near Baltimore. Fire fighters were fortunately able to extinguish the blaze before major damage was done.



International.

This fire in the world's largest gas holder in Chicago occurred when an Army bomber crashed into the side of the gas holder near the Chicago Municipal Airport on May 20, 1943. Twelve men were killed and the gas holder was completely wrecked.

exhaust fires during starting operations, and while elimination of such fires is utopian in goal, a reduction can be effected if proper attention is paid to the standard procedures provided for in Technical Manuals issued by the Army Air Forces. Exhaust flare-ups are in 9 cases out of 10 minor as to damage and effect. It is only when negligence has allowed accumulation of oil and filth at the exhaust outlet that fires of any consequence develop. When such conditions exist, fires may be temporarily extinguished on the ground by the use of carbon dioxide extinguishers, but later reignite during or immediately after the take-off. Such exhaust fires have been known to reach as far back as the tail wheel, causing destruction of the rubber tire, and if allowed to get hot enough, will seriously weaken the skin surfaces.

The second most common fire source is the fuel lines. Ground maintenance crews are too often negligent about tightening the nipples and connections, and vibration of parts causes loosening, resulting in the spraying of gas, oil, or hydraulic fluid on hot engine parts. The prevalence of this danger has been recognized by the installation of carbon dioxide installed systems in most of the combat aircraft weighing over 15,000 pounds basic weight, except in day fighters. This installed system has been added at the expense of vital weight considerations and would not have been done had it not been recognized that the fire hazard in the accessory section of the engine was a serious threat to flying safety. Pilots are carefully instructed as to the operation of this system, which is controlled from the cockpit and when crashes may be anticipated, besides cutting off the fuel supply and electrical power, they are instructed to actuate the carbon dioxide systems. In many cases this is not possible since the crash occurs too quickly to permit such action. Fire departments answering crash alarms will have few cases where they might extinguish the fire by the use of this system, but should have the knowledge of its presence for that remote chance. Controls are clearly marked and are located on the floor between the pilot and co-pilot, or on the control panel.

Electrical short circuits have been the third major source of fire in the nacelle section. Again the presence of excessive oil on engine parts has been the contributing factor in the spread of such fires. Cleanliness is not only a household requirement.

Fuel, oil, and hydraulic lines outside of the engine proper form the second category of fire hazards. Loose connections from unusual strains or jolts have caused leakage, with the consequence of ignition. These occur in the air in altogether too many instances. Fuel lines, leaking in confined spaces, set up a severe explosive-vapor condition in such sections as the wing, beneath deck boards, and surrounding enclosed fuel tank sections. When such explosions occur, the destructive effects register themselves in the pushing out of rivets and weakening of structural parts to such an extent that crashes might be inevitable.

The fire hazard from the small quantities of flammable liquids used as hydraulic fluid is nominal compared to the quantities of gasoline usually present. The fact that important airplane parts are hydraulically controlled is of importance to firemen. For example, the burning out of some hydraulic lines may cause a release of the brakes of an airplane and result in a dangerous movement of the aircraft. Hydraulic tubing should not be cut carelessly, but where such tubing obstructs rescue operations firemen should feel no hesitancy in cutting it. Care should be exercised in this operation, however, as the pressure of the fluid may be as high as 1100 lbs. per square inch and may discharge with violence when the tubing is severed. This pressure may be reduced by operating the bombay doors or wing flaps until pressure is 0 lb. per square inch. The fluid used in an airplane hydraulic system is either a specially prepared mineral oil containing red dyes or a fluid consisting of a mixture of alcohol and castor oil containing blue dye. The quantity of the fluid used is comparatively small, varying according to the size of the plane from 1 to 12 gallons.

Oxygen systems have explosive potentialities. This is not only true during maintenance, but also as a result of carelessness or faulty workmanship the difficulty may show itself when aircraft is in flight or taxiing down the runway. Fire is a constant companion to oxygen explosions. The presence of grease or the products of petroleum is sufficient to cause explosion when exposed to oxygen under pressure. Numerous cases are on record where oxygen in contact with oils, greases and hydraulic fluids has caused rapid oxidation, with explosive effects.

Anti-icing and de-icing systems present another fire hazard. Only the anti-icing system need ordinarily be considered; the hazard here is that of flammable liquids.

Cargo and cabin fires on record have largely been from the practice of carrying flammable substances and the careless use of cigarettes and matches. Regulations have been promulgated to prohibit the shipment of flammable substances and have included wet battery acids, corrosive liquids, toxic gases, explosives, and paint, dopes, and lacquers, unless packed in double sealed or tripletite friction top cans and an outside container. Unfortunately these regulations have been violated, resulting in several crashes, causing the loss of both aircraft and personnel.

No cases are on record where ammunition has been the cause of fire, except enemy fire. However, ammunition will contribute to the intensity and spread in a marked degree, depending upon the type of explosive present.

Conclusion.

Municipal fire departments can be of great assistance in airplane crash fire fighting. We hope this article will provide some new ideas on the basic principles of communication, response, approach, agents, crash tools and aircraft hazards. We have just scratched the surface of all of these, but have tried to mention the more salient points. We would welcome your comments, questions, and reports of actual experience, in fact urge them. It is a common problem and requires the thoughts, energies, and best efforts of us all to conquer what is unquestionably the biggest fire problem of not only the war period, but the generation. Municipalities must prepare themselves for the air world of peace as well as the air war of today.

Fish Cannery Fire Protection.

$750 Prize Contest.

Prizes totaling $750 are offered by Durham and Bates (members N.F.P.A.), of Portland, Oregon, for the best solutions to the difficult problem of providing adequate fire protection for fish cannery properties located at remote points along the northern Pacific coast. All personal N.F.P.A. members and employees of member organizations are eligible to compete, except that entries will not be received from members of the N.F.P.A. staff or employees of the judges.

Prizes will be awarded as follows: First prize — $500; second prize — $100; third prize — $50; four consolation prizes — $25 each. The prizes will be awarded in accordance with the findings of the judges, whose decision will be final. The judges are Mr. A. L. Gile, President, Chinook Packing Co., Chinook, Washington; Mr. C. F. Wagner, Manager, Oregon Insurance Rating Bureau, Lumbermens Building, Portland 4, Oregon; Chief Edward Grenfell, City of Portland Fire Department, Portland, Oregon.

All contestants must submit their answers to the N.F.P.A. office on or before April 1, 1944. Answers must be typewritten on one side of 8½ x 11 paper. Any drawings or other materials accompanying answers must be folded to 8½ x 11 size. Answers must be on plain paper, with no information to identify the name or business connection of the author. The name and address of the contestant should be given in an accompanying letter, which will be detached in the N.F.P.A. office and the papers will be sent to the judges identified only by a serial number.

All answers submitted, irrespective of whether or not they are prize winners, will become the property of Durham and Bates for such use or publication as they may desire.

There is no limit in the length of the answer submitted, but preference will be given to answers in the shortest form consistent with clear presentation of the information. Contestants should note that the judges are familiar with fundamentals of fire protection and that there is no occasion in their answers to include detailed descriptions of fire protection equipment of common recognized types. Any special forms of fire protection equipment proposed should, however, be completely described.

Announcement of the results of the judging will be published in the N.F.P.A. QUARTERLY or NEWS LETTER as soon as the judging is complete, and the prizes will be promptly distributed to the winners.

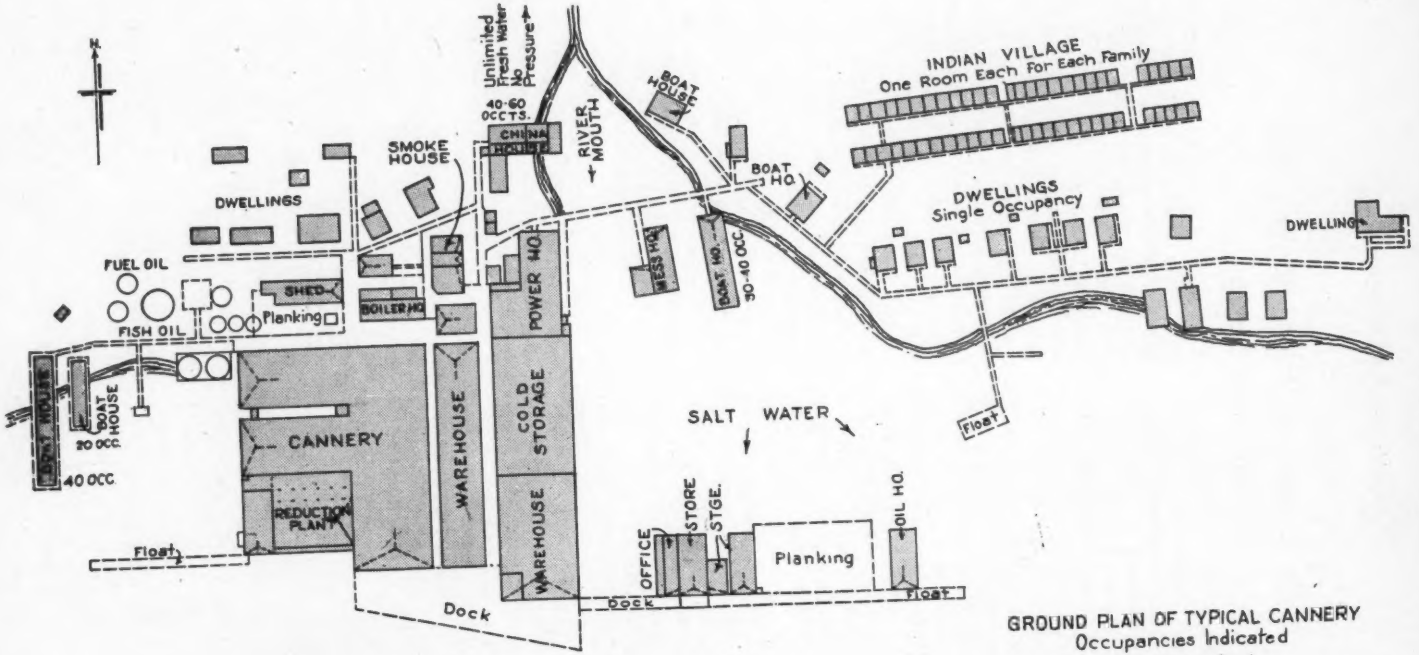
Brief of Cannery Fire Protection

The purpose of this outline is to present to the various contestants a picture of a cannery area, giving to each contestant full information as to the various circumstances surrounding such a plant, in order that they may present their ideas as to the best methods of fire protection and the reduction of fire loss.

The various points which must be considered will be grouped into various classifications, taking into consideration the areas involved, locations, construction and other features. For the purpose of this contest it is to be assumed that there is no fire protection at this cannery. Usual water supplies will be described and it will be the work of each contestant to adapt the information given to his idea of the best means of fire protection.

Location.

The cannery in question is located in a remote part of the northwestern coast. The surrounding territory is as pictured, on salt water, for the most part sheltered, but of necessity located in an area contiguous to the fishing grounds. Very rarely is there exposure from other form than common occupancy. Transportation to this location is entirely by boat, with not too frequent regular calls by coastwise steamers.



GROUND PLAN OF TYPICAL CANNERY
Occupancies Indicated

Scale in feet
0 100 200

DURHAM & BATES
Portland , Oregon.

Fish canneries are located in remote parts of the Northwestern Coast on bays or sheltered salt water inlets. The country behind is largely unbroken woods. Transportation is only by water, with not too frequent calls by coastwise steamers.

An airplane view of a typical cannery, with the buildings largely constructed on piles or platforms supported on wooden piling. The necessity of providing wharves for fishing boats and the mountainous wooded character of the shore have combined to make this sort of construction almost universal.

Weather.

The weather at the locations involved is quite variable. There is considerable rain throughout the year, but the winter temperatures have been known to go as low as six degrees below zero, with considerable snow. Spring and fall seasons sometimes produce wind to a velocity of between 50 and 60 m.p.h.

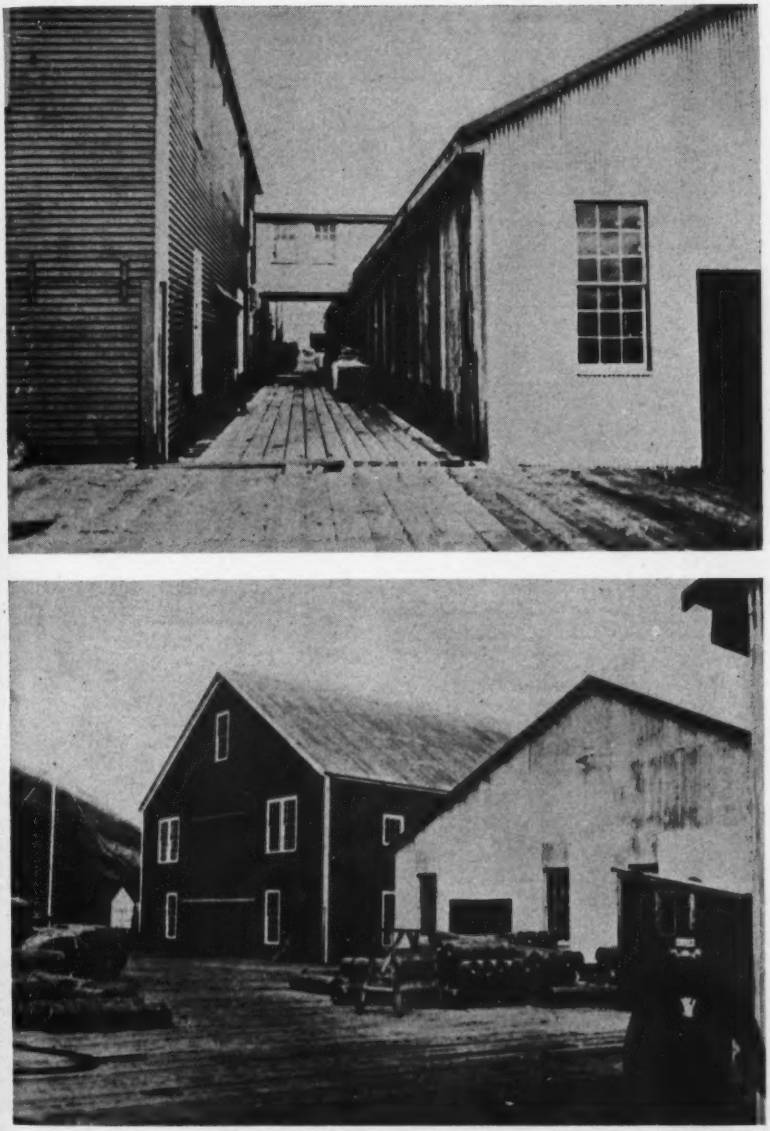
Although the humidity at the various locations is generally quite high, there are occasions when the relative humidity sometimes drops to 30.

Another feature of the weather that should be considered is that on rare occasions there is a prolonged dry spell with temperatures ranging between 75 and 90 degrees. This is a critical time for the canneries, since the large wooden areas such as platforms and net racks become very dry and, and as they are constructed of rough planking, they become quite flammable.

Construction.

The usual cannery group consists of the main cannery building, net houses, boiler house and power plant; canned goods warehouse, boat storage, reduction plants, cold storage and domestic buildings. These buildings are all of frame construction, for the most part located on piling. Occasionally, some of the smaller domestic buildings are located on solid ground, but the operation usually requires at least a large part of the process areas to be located on piling. This is made necessary for the reason that boats must be moored alongside the fish receiving areas. Another factor that must be considered under this heading is the large tides, sometimes approaching 20 feet. It is thus seen that at certain stages of the tide there is a considerable open under area which presents a severe problem.

The cannery buildings are of single frame construction with the floor decks not to exceed two-inch planking. Owing to the loads that these buildings carry, the timbers and supporting members are usually heavier than average. The roof is of corrugated iron and gabled. The construction of the cold storage units is usually superior, owing to the necessity of protecting very low temperatures from sharp freezes. It is also necessary that the cold storage area be of excellent construction, due to the tremendous weights in frozen fish which the building is called upon to carry.



Typical views of cannery buildings on wooden piers or platforms. Supported on piling over tidewater, the entire platform area as well as the frame buildings themselves may be subject to destruction by fire.

Fishing boats line the wharves during the busy season; the storage and handling of gasoline and oil for their operation is a hazard of some magnitude.

The reduction plant is of normal light construction similar to the cannery. The difference in processes in these buildings will be described under the heading, Reduction Process.

The net houses are usually detached at least 50 feet from the main cannery area. Owing to the work carried on in these net houses, it is necessary that they be well ventilated. Such work will also be described later.

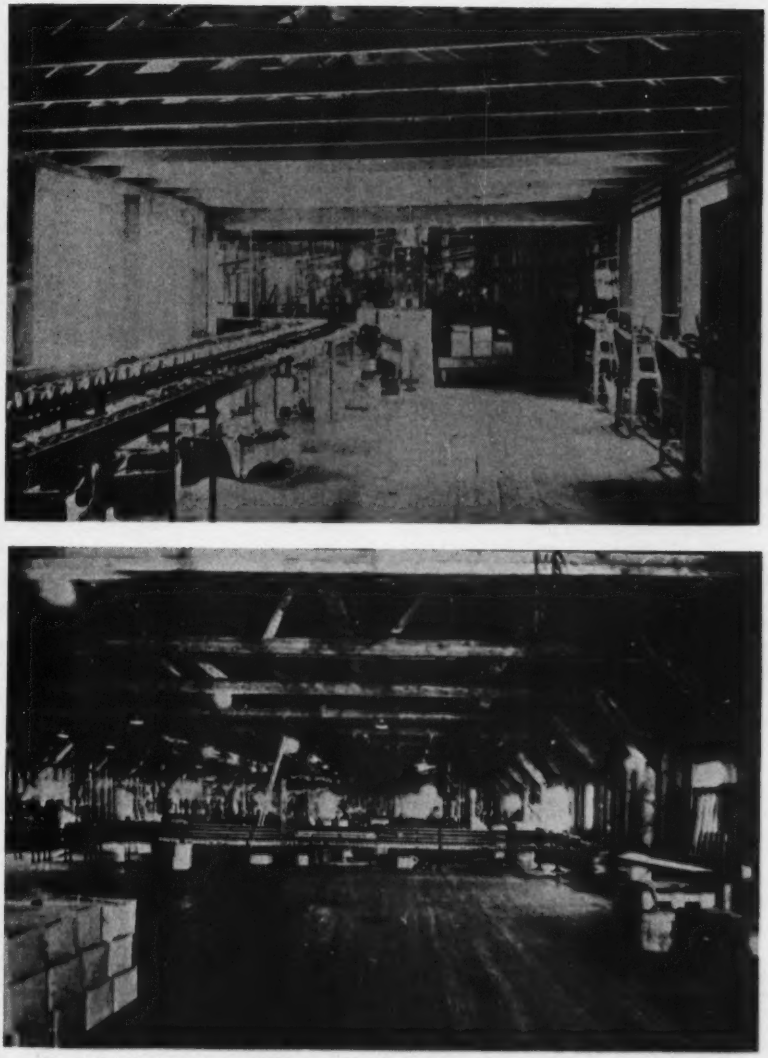
The boiler house, usually powered by coal or oil, which furnishes the steam for the canning process is located 25 feet from the cannery building, but usually on the same platform or piling area. Surrounding the cannery are domestic buildings, the largest of which is the China house, which is the dormitory used by the Chinese labor at this cannery. This building houses some 40 men.

The store and office building, which is also a part of this group, is of usual light frame construction, under supervision at all times. Since the area involved must be self-sustaining, it is necessary that all supplies used in the domestic life of the cannery workers and their families be served through this store.

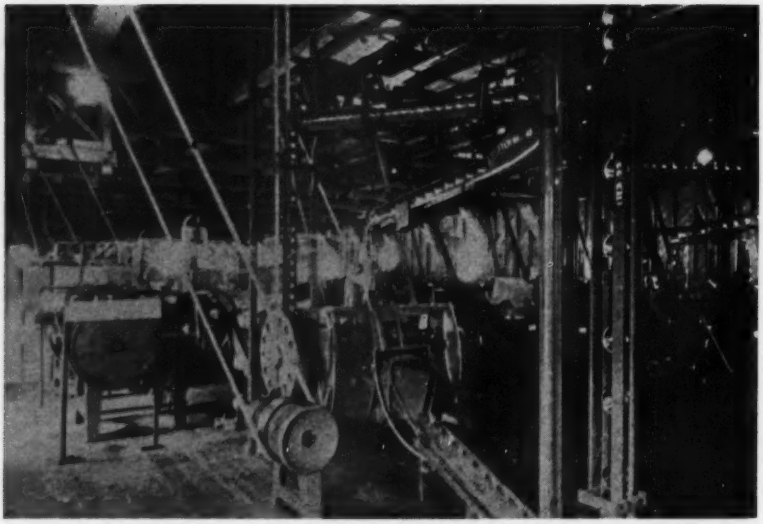
The remaining buildings in the domestic group consist of small, single-roomed cottages, usually not exceeding 200 to 250 square feet, which house the Indians and other seasonal workers. These buildings are for the most part poorly taken care of and present one of the most severe problems to a cannery manager, since there is little responsibility on the part of the occupant. It is to be assumed that there is little regular supervision over these domestic buildings. There are three or four small dwellings of the better class, properly constructed with good chimneys, which house the Manager, Superintendent, Office Staff and Storekeeper. These are usually detached from the Indian houses described above and present little problem.

Cannery Process.

The canning of fish is a line operation, the process starting at the fish receiving gate where the fresh fish are graded and sorted. From there the fish go through several stages of being cleaned, inspected, cut, and are finally filled in cans. The cans are then run through a vacuum sealer, after which they are placed in trays and taken to a steam retort. These retorts are steam pressure vessels in which the salmon are cooked at a temperature of probably 300° F. for a period of approximately two hours. The retorts are then exhausted, the



Typical interior views of fish cannery buildings. The structures are largely open areas, with no interior barrier to the spread of fire. Many of the floor areas are soaking wet during fish cannery operations, as a large quantity of water is used for cleaning. The exposed wooden roof trusses are, however, vulnerable to fire, and during the months when the canneries are closed the floors and all the wooden work have opportunity to become completely dry.



Another interior view, showing the type of machinery used in canneries.

cans allowed to cool and the finished product is stored after being packed in cases. During this entire process, the areas involved are generally soaking wet, since there is running water for cleaning constantly covering the area in fair quantities. The only process using steam is the retort as described, and if due precaution is taken with steam pipes, the retorts present very little hazard.

Reduction Process.

Fish reduction consists of extracting from fish and fish offal the essential oils and also using the residue after such oil extraction to make various meals which are useful as fertilizers and stock food. The raw product to be reduced is taken first to large cookers, during which process the oil is separated from the offal. This oil is precipitated to large settling tanks and allowed to cool. After the oil has been extracted, the residue travels to a long tubular drying kiln. This kiln is usually some 80 feet long, with the meal entering at the far end from the burner. The circular rotation of the kiln draws the meal toward the burner, and the intense heat which is produced by this burner extracts every bit of moisture from the meal. The meal is then drawn off, sacked and stored away, awaiting shipment. Fish meal has a tendency toward spontaneous combustion, which must be considered. Fish oil has a very high flash point, but the storage in open vats presents a problem. The steam for the reduction plant operation is usually furnished by the cannery boiler house.

Net Houses.

In the preparation of nets for service in fishing, there are two types of treatment which must be considered from a fire hazard standpoint. The first treatment for gill nets is soaking the nets in linseed oil and allowing them to dry. This is done in a detached building known as the net oiling house; the warranty of their insurance prohibits the oiling or drying of these nets in the cannery area. After a period of 15 days has elapsed, it is permissible to store these nets in the cannery building. This, however, is usually not done. For the larger nets, known as seines, a tarring process is carried on in a detached building under restrictions similar to the net oiling process.

Operation in General.

It must be considered that a cannery is not merely a place to can fish. Due to the location and isolation, it is necessary that each cannery be in effect a small city. The

Wooden walkways supported on piling connect the various buildings.

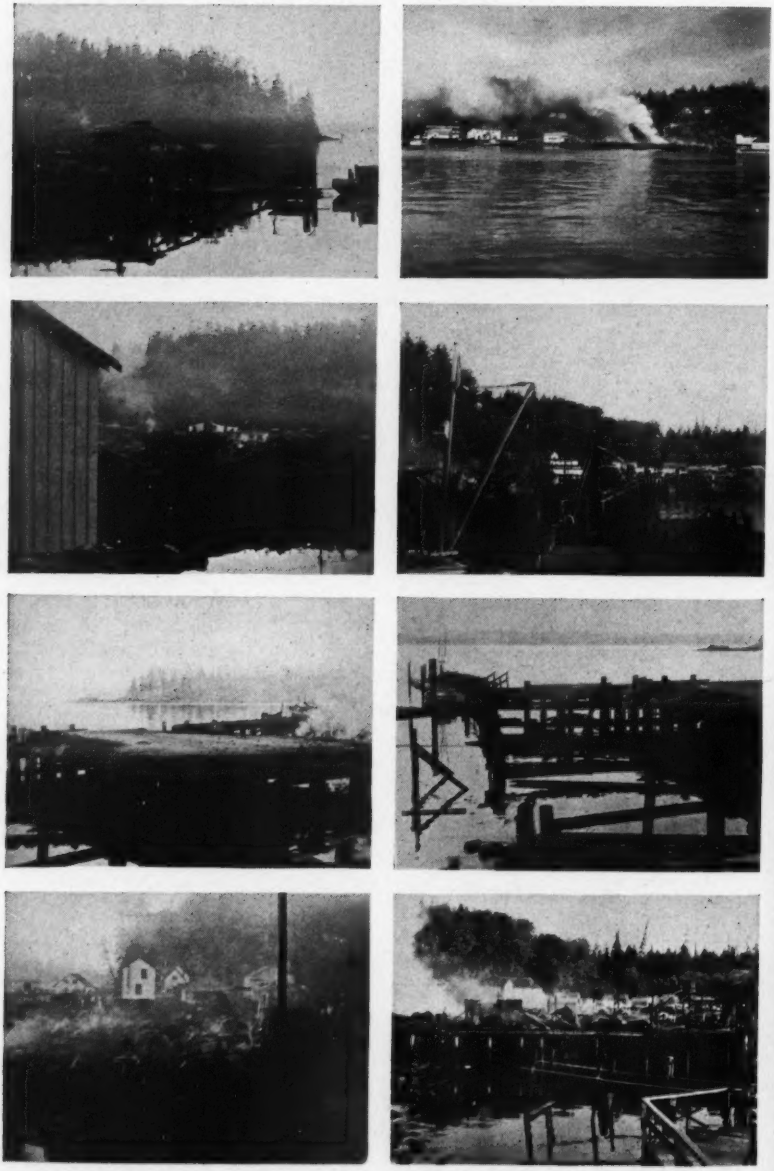
operation is distinctly seasonal, starting usually during the month of April and closing not later than October. During the period of operation, there may be as high as 300 employees of all classifications. There is a high percentage of native Indian help. The men of the families carry on fishing operations while the women and some of the children work in the cannery. During the operation season, a cannery site is an extremely busy area with no definite working hours. The fish must be placed in cans as soon as possible after receiving, and as a consequence it is not unusual to have a twenty-four hour shift. In contrast to the operating season, the closing season is one of almost complete desolation. The large cannery areas are left in the hands of a manager, watchman, storekeeper and a few local employees. During the operating season there is a group of white help that could be considered the nucleus of a fire fighting force, but the average employee at a cannery is of an intelligence that does not lend itself to training from a fire fighting standpoint.

Water Supplies.

There is, of course, always unlimited salt water at each cannery location. There is generally unlimited fresh water, but rarely having the pressure necessary for adequate fire protection. Many of the processes of a cannery require the use of fresh water, but not necessarily at any great head or pressure. In considering the distribution of water among the various buildings, it must be recognized that the use of wooden mains is almost mandatory for the main distribution system. It must also be recognized that the majority of the mains must be above ground located on walks and piling throughout the cannery area. The locations involved usually have a freezing season in the winter, which must be considered from the standpoint of construction of projected mains and in first-aid appliances. In the use of salt water, it must be considered that the large tides involve a considerable lift and usually a long suction line if pumps are recommended. For mobile fire fighting equipment, it must be recognized that walkways to domestic buildings are, for the most part, narrow, not exceeding four to five feet in most instances. The cannery area is not so handicapped.

Storage of Flammable Liquids.

There is at each location a large storage of diesel fuel, crude oil and gasoline. In addition to its various uses throughout the cannery and reduction plant, it is necessary to serve the numerous boats belonging to the cannery operators or to the fishermen themselves. The tanks for this storage are usually located away from the cannery area, but serve the cannery area



Fish cannery fires in isolated locations where there is no adequate protection available are usually total losses.

This picture shows the congested character of the construction, making it probable that in the absence of protection, fire starting in any unit will result in a total loss of the entire property.

through loading docks or floats. This service is by gravity, and rupture of a fuel oil line would aid materially in the spread of fire.

Values.

In the consideration of protection to be afforded at described location, it must be recognized that the values of the building and equipment involved are usually in the neighborhood of $500,000. In addition to this value, there are seasonal values on stock which may approximate another $500,000. These stock values, of course, are highly fluctual and diminish greatly after the normal operating season. The fire insurance rate is approximately 1% per year. In addition to consideration of the values involved, it must be also borne in mind that the finished product of these canneries is extremely essential to the war effort, and that the machinery used in the canneries' various operations is impossible to replace.

Summary.

It is hoped that the above details will serve to give each contestant a mental picture of a cannery operation. It is the purpose of this contest to have each contestant submit his or her idea of the best possible means to prevent fires, to minimize damage should fire occur and to confine losses to as small an area as possible. We ask that in the consideration of this problem the use of entire masonry construction not be considered, since it is impracticable in locations such as those described. We ask also that your treatment of this problem deal with the main buildings as they now exist.

International.

October 11, 1941. Fall River, Mass. By one unfortunate turn of the wrist a watchman prematurely shut off automatic sprinklers during a fire in this rubber plant. Loss: $11,000,000.

An Analysis of Watchman Failure.

By Melvin R. Freeman, N.F.P.A. Staff.

Watchmen are an essential part of the protection of any plant. Many times, quick cool-headed action by watchmen has averted potential damage. Yet, if a monument were needed to signalize the economic significance of watchman failure, it would be the smoking ruins of the Firestone Rubber and Latex Corporation in Fall River, Massachusetts, where on October 11, 1941, one-tenth of America's crude rubber supply went up in smoke. By one unfortunate turn of the wrist a plant watchman shut off the sprinkler system prematurely and allowed an incipient fire to develop into one of the most serious fire losses that ever occurred in a sprinkler-protected property.

Some managers attach little or no importance to the watch service and regard the watchman in much the same light as they do first aid fire appliances: necessary local color for a busy plant. The custom, which still prevails among plant managers and others, to engage as night watchman some superannuated employee, no longer able to earn a workman's pay, is toying with disaster. Such watchmen may make their occasional rounds of inspection in a purely mechanical way, but the amount of real protection furnished, especially in war time, is very small. Indicative of this lack of protection arising from a poor watch service is the classic test conducted by Government officials in World War I, when inspectors were sent into a plant during the night, without the knowledge of the aged watchman. These inspectors spent six hours within the plant and made drawings of many of its most important features, but their presence was never once detected!

The alert, intelligent and responsible watchman is an important factor in discovering fires in their incipiency, so that prompt measures can be taken to minimize damage. The watchman of low mentality may be more of a liability than an asset. In numerous instances, as this study will show, fires have been due to smoking by watchmen, or their carelessness with oil lanterns. Watchmen's failure to discover and report fires promptly, their shutting off of sprinklers without ascertaining whether fires have been extinguished, their ignorance of proper sprinkler valves to close after the fire is extinguished, or of whom to call upon to get salvage work started promptly is often responsible for heavy losses.

Failure of watchmen to perform properly their duties was a major factor in about ten per cent of 1942's large loss fires (fires involving losses of $250,000 or over and summarized in the January, 1943, and April, 1943, QUARTERLIES).

In an effort to study watchman failure as it affects the incidence of fire, the N.F.P.A. Department of Fire Record took 178 typical cases of watchman failure from its files. While most of these fires were peace time fires, occurring in plants which operated on a single daytime shift, the pattern of watchman failure would be the same in war time. In peace or war it is the human factor which accounts for these failures which are resulting in such large losses to American industry.

Why *do* watchmen fail? The study reveals that 41.1 per cent of the failures were due to the watchman's failure to notify the fire department promptly of the outbreak of the fire; 34.3 per cent of the failures were due to watchman delinquency; 21.8 per cent were due to the improper use of existing fire protection equipment (mostly automatic sprinklers) and 2.8 per cent were due to the poor planning of the watchman's route. Although this is not a tabular examination of watchman failure, it seems worth while to reproduce the causes of the 178 cases of watchman failure, herewith:

(1) Delayed Alarm	**73**
Fought fire before notifying fire department	15
Telephoned employer or employee before calling fire department	15
Did not properly operate fire alarm	15
Failed to call fire department at all	6
Pulled wrong fire alarm	4

Completed rounds before summoning fire department 3
Lost time looking for fire alarm; overlooked near-by telephone..... 3
Did not know how to give fire alarm.... 2
Failed to stay at fire alarm box to direct firemen 2
Watchman confused..... 2
Did not know how to operate telephone switchboard 1
Forgot how to send in alarm..... 1
Couldn't find telephone..... 1
Called City Hall for permission to summon fire department..... 1
Saw smoke but wouldn't send in alarm until he saw flames..... 1
Watchman couldn't speak English..... 1

(2) Delinquent Watchmen.....61

Did not discover fire at all.....14
Did not discover fire promptly.....13
Left plant without permission.....11
Asleep 11
Skipped rounds..... 4
Watchman's carelessness started fire..... 4
Skipped rounds, falsified records..... 2
Did not start round promptly..... 1
Intoxicated 1

(3) Improper Use of Fire Protection Equipment 39

Shut off sprinklers
Prematurely 16
Prior to fire..... 4
Failed to shut off sprinklers..... 7
Failed to use first aid equipment..... 4
Failed to start fire pump..... 2
Did not know meaning of sprinkler alarm. 2
Did not know how to operate first aid equipment 1
Had not restored sprinkler protection.... 1
Failed to close tank valve..... 1
One-armed watchman unable to operate extinguisher 1

(4) Poor Planning of Watch Service Route.... 5

Watchman not required to make rounds where fire started..... 3
No regular round..... 2

There is an old fire fighter's maxim that "the first five minutes at a fire are worth the next five hours." Failure to notify the fire department promptly, or delayed alarm account for 41.1 of the watchman failures. Three equally divided causes account for 61 per cent of the delayed alarms in this study: (1) the apparent fear of the watchman to take the responsibility of calling the fire department; (2) the watchman's effort to fight the fire before calling the fire department and (3) improper use of fire alarm equipment. In nearly 10 per cent of the delayed alarm cases the failure to find a telephone or the telephone number of the fire department or how to operate the telephone switchboard was responsible for the delay. In another 10 per cent, the watchman failed utterly to notify the fire department even after the fire was discovered.

Elimination of these causes of watchman failure is extremely simple. There is no need for watchmen to be "afraid" to call the fire department. Certainly, there is no explanation for the Norristown, Pa., watchman who called City Hall for "permission" to summon the fire department when his plant was on fire. Another apparently did not believe in the old adage of "where there's smoke, there's fire," for he steadfastly refused to call firemen until he saw flames, in spite of the billowing smoke. Unless the watchman can immediately extinguish the fire, his first job is to call the fire department.

There is no need for plants to burn up because a watchman couldn't find a fire alarm box, a telephone, or the telephone number of the fire department. The record is full of cases where watchmen went considerable distances (one ran a quarter of a mile) to telephone the alarm when there was a telephone immediately at hand. One watchman wasted considerable time trying to locate a telephone when there were two fire alarm boxes in the building. Loss: $750,000. One excited watchman forgot how to operate the fire alarm and ran several blocks to fire department headquarters only to give them the wrong location of the fire. Another didn't know how to sound an alarm and just ran out into the middle of the street, madly blowing his whistle. Finally, a storekeeper attracted by the whistle gave the alarm. Loss: $210,000. The record is full of cases where the watchman pulled the wrong alarm box or boxes that had been disconnected.

The watchman should know the exact location of all fire alarm boxes — public and private. He should know where all telephones and switchboards are located, how to use them, on whom to call for aid in case of emergency and how to get in

Watchman's delay in notifying the fire department was a major loss factor in this warehouse fire, which was Boston's worst in 30 years.

touch with proper authorities. Typed or printed instructions on how to give the alarm should be prominently displayed (preferably under glass) near all fire alarm boxes, telephones, and switchboards. One plant superintendent vainly tried to telephone the fire department for 25 precious minutes only to learn that the number which the watchman had given him was in reality the telephone number for the corner grocery store. Loss: $100,000. Carelessly penciled fire department telephone numbers on painted walls have accounted for many fire departments arriving at the fire — with too little and too late.

For example, here is a case of delayed alarm in Lexington, N. C., where the watchman did practically everything *but* call the fire department. Quoting a rating bureau report:

Watchman claims he had just started his round about 1 A.M. and had visited watch station No. 1, on the yard near the boiler room, and had almost reached station No. 2, also on the yard, approximately 500 feet south of the plant, when he heard a bell ringing, which he thought was a sprinkler gong. According to his statement, the watchman turned toward the factory and saw a blaze through the windows on the south side. Entering a south-side entrance to the first floor, he observed fire under and around a planing machine, which at the time is said to have been only a small blaze. Hurriedly, he proceeded to the superintendent's office on the east side of the building and telephoned the superintendent, then the owner. No response could be obtained from either official, although the telephone appeared to be in working order. No attempt was made to call the fire department. The watchman then went to the north private hydrant and pulled out one line of hose, carrying this into the north basement door; he fought the fire ineffectively for several minutes and abandoned the hose line. Then he decided to go for help and hastened approximately one-quarter of a mile to the house of a company employee, who, upon being awakened, dressed and returned to the plant with the watchman. After observing the fire and hearing bells ringing this employee returned to his home, got his car and proceeded towards town for the purpose of turning in an alarm at the nearest fire alarm box. However, coincident with his reaching a fire alarm box, the fire apparatus passed him and went on to the burning plant. An alarm had been turned in by a watchman at a cotton mill a mile distant from the fire. Loss: $75,000.

Watchman at this large unsprinklered warehouse in New Orleans was not aware of this fire until the fire department was arriving. Loss: $1,285,345.

These watchman failures are expensive and their elimination is extremely elemental. Proper alarm equipment should be installed for the watch service and the watchman should be thoroughly drilled in the procedure of reporting a fire, making sure that he knows the location of all alarm equipment and its operation.

In peacetime, watchmen are in charge of the plant about 68 per cent of the week, yet many plant managers give little or no attention to their proper selection. Results of this lack of appreciation of the watchman's importance in the plant protection picture are graphically demonstrated by the high frequency of delinquency in the record of the 178 cases under study. Delinquent watchmen stand second on the list of major causes of watchman failure, accounting for 34.3 per cent of the failures.

One watchman in a Newark, N. J., plant had one night a month off, but the owners did not know when he took it off until they saw the time sheets. A four-alarm fire broke out in the unprotected plant during one of the watchman's "nights off," and the company suffered a large fire loss. Another watchman in a Wichita Falls, Texas, office building was given permission to attend a midnight mass and left a young elevator boy to watch the building. Loss: $100,000. Several watchmen in the record skipped their rounds and falsified their records; one watchman obtained a watch key and periodically tampered with his watchclock in order that he might frequently absent himself from the plant. Eleven of the watchmen left the plant unguarded without permission; many of them would give no reason for leaving the plant except that they were "tired." One watchman slipped home for supper, between rounds, and returned to find his plant in flames. Loss: $25,000. Twenty-seven of the watchmen did not discover the fire promptly or at all, and some of the alarms were transmitted from locations as far away as a mile from the scene of the fire. Eleven of the watchmen went to sleep on duty; one watchman in a mattress factory could not resist testing the company's product and was still blissfully sleeping when the firemen arrived. Four watchmen were responsible for starting the fire — all concerned with the improper use of flammable

A watchman in this Lexington, Ky., whiskey warehouse used gasoline to start a fire in a small stove. He was fatally burned by the resulting explosion and four whiskey warehouses were destroyed, with loss of $2,655,000.

liquids. One watchman was fatally burned and four whiskey warehouses were destroyed with a loss of $2,655,000, when he used gasoline to start a stove fire.

The record shows that only 37 of the 178 plants under consideration had some form of supervision for their watchmen. Only nine of the plants had central station supervisory service, most of the supervised watchmen relying on watchclocks.

Again the answer to delinquency as a cause of watchman failure is simple. Management should give more attention to the proper selection of the watchman. He should be a man of excellent character and habits, mentally and physically fit, be able to write simple reports and be mechanically minded. The watchman should be given support by proper equipment, proper instruction and proper supervision, preferably by central station supervisory service. Above all, he should be continually "sold" on the responsibility of his job, encouraged to study more about fire control, and be paid adequately.

If, as in the case of most large plants, the watchman patrols sprinkler-protected premises, he must be familiar with the system; how and why it operates, and how to coöperate with it. An occurrence in a Chicago leather plant is a perfect example of gross incompetence in this respect. While making his rounds the watchman came upon the remains of a fire that had been extinguished by twenty sprinkler heads. As he was a bit behind in his schedule, and there was a deluge pouring from the sprinkler heads to take care of any remaining spark, he completed his next round before calling up the plant engineer, who told him how to turn off the flow of water. He found a valve and shut it, but it was the wrong valve and the water continued in its torrential downpour, doing large and unnecessary damage.

Over a period of forty years sprinkler systems have proven more than ninety-six per cent efficient in controlling fire. They are subject to human error, however, because they are controlled by shut-off valves. An untrained watchman, on hearing a local sprinkler alarm, often will rush to the control room and close the valve; then he may or may not investigate. If there is a fire, it will be given a chance to grow beyond control — to spread to other floors, other rooms, before the sprinklers can be turned on again. The one leading cause of sprinkler failure is human failure.

Ninety-four out of the 178 premises represented in this study were sprinklered. Yet in the light of the excellent record of 96 per cent control of fires represented by the forty-year all-industry average, the record of these sprinklered occupancies was bad. Forty-two out of the 94 cases were sprinkler failures.

About 50 per cent of the sprinkler failures were due to the watchman's shutting off the sprinklers prematurely or prior to

the fire. In seven cases the watchman failed to shut off sprinkler equipment after the fire had been extinguished. One watchman would not go near the open sprinkler heads because of the fear of being drowned. In two cases the watchman did not start the fire pumps. In one case the watchman failed to shut off the sprinklers, although it was obvious that the sprinklers were failing completely to control the fire and there was a wholly inadequate supply of water for the firemen to fight the fire. Loss: $250,000. In one Canton, Mass., rubber plant watchmen shut off the sprinklers because they thought the fire could be extinguished by first-aid appliances and a $1,906,000 fire resulted.

Here is an example in a New York City garment worker, showing what can happen when the watch service is not familiar with the fire protection equipment. Quoting from the rating bureau report:

About 7:30 P.M. the watchman on floor No. 20, "South Building," noticed water coming through the ceiling near the northwest corner of the room. He immediately called the elevator man and asked him to notify the head watchman. Arriving at floor No. 20 a few minutes later, the head watchman was unable to enter, as he had neglected to take the key with him. The watchman on this floor was locked in without a key.

As the watchman on floor No. 20 had told him that water was flowing down the outside of the building as well as on the inside, and as the sprinkler alarm had failed to operate, the head watchman concluded that the leak was due to the sprinkler tanks overflowing and went to the roof to investigate. Finding that the tanks were all in order, he returned to the office on the first floor of the North Building to get the key to floor No. 21.

The head watchman then wasted considerable time by returning each time for the keys to each floor, respectively, during the examination process. Finally reaching the 23rd floor, the head watchman then found considerable water coming from the ceiling, and as the only light available in this room was from the flashlight which he carried, he concluded that a sprinkler head had opened and he immediately shut off the valve controlling the sprinkler system in this room. The water continued to flow, however, and he repaired to the top floor and shut off the sprinkler valve for that section. Upon further investigation he found that a sprinkler had opened in the janitor's closet, extinguishing a fire that had started in a wooden rubbish barrel, apparently due to spontaneous ignition.

Instead of immediately summoning aid, he then made a round of the various floors of the building to see how far the water had penetrated, and when he finally called the other watchmen they had already started on their rounds, thus causing further delay. Before proceeding to clean up the water the watchmen had to be provided with rubber boots, which could not be found for several minutes.

About this time (10:05 P.M.) the power for the only available elevator was shut off to make changes on the electrical switchboard in the basement of the South Building. This was allowed without protest by the chief engineer, who arrived at about 8:15 P.M. When everything was in readiness for the cleaning up of the premises it was discovered that the power would not be on for half an hour, so the men walked to the 23rd floor and found that they could not break into the premises. The keys, which are for elevator doors only, are kept in the office in the first floor of the North Building. At 10:45 P.M. the power was restored and salvage and cleaning operations were begun. Complete protection was restored to the sprinkler system by midnight. As the three pressure tanks supplying the sprinkler system in this section were empty after the fire, it is believed that the fire started at about 3:30 P.M. (four hours before it was discovered). Loss: $20,000.

Statistically, the record of the 178 fires under consideration shows only five cases of watchman failure directly attributable to poor planning of the watch service. Yet, directly or indirectly, this factor enters into most of the cases in this record. Graphic evidence of this is a study of the incidence of the 178 fires — where, when and how the fires broke out. By doing this, a general over-all picture can be determined of just where the watch service is falling down in its inspections.

The study shows (1) that while most of the fires started in storage and packing rooms and boiler rooms, high on the list of favorite places for fires to start were such out-of-the-way places as rubbish chutes, elevator shafts, locker rooms and toilets; (2) that while most of the fires were caused by spontaneous ignition (poor housekeeping), careless smoking and defective electrical equipment (in that order), high on the list of fire causes were electric or gas heaters left on, machine "hot boxes," amateur wiring hazards,

greasy clothes in lockers, etc., hazards which could only be discovered as the result of thoroughgoing inspections; (3) that 50 per cent of the fires broke out before midnight and 32 out of the 178 fires in the study broke out in the first four hours after the watchman went on duty.

These findings add up to one conclusion: If the watchman's route had been properly laid out (especially the first round) and conscientiously followed, many of these fires would have been discovered in their incipiency.

The watchman is a fire inspector. His route should be carefully laid out and the Inspection Department having jurisdiction should be consulted so that every nook and cranny of the plant will be subject to inspection. A plan or other record of the route should be preserved so that as new areas and hazards develop the route can be changed to accommodate them. The route should take the watchman through the entire area, not permit him to use short-cuts nor retrace his steps and it should not require more than 40 minutes. More about the watchman's duties can be found in the N.F.P.A. pamphlet, "The Watchman," which may be obtained from the Executive Office.

The watchman's first round is most important. This should be a real inspection of the premises. During it conditions will be found and corrected, which otherwise might cause fire during the night. It should begin as soon as the day's activities stop, for where running machinery is involved, hot bearing fires usually develop just after shutting down the machinery, rather than when it is in operation. During the first round, the watchman should make sure that the property is properly closed for the night. He should see that (a) outside doors are closed and locked, windows, skylights, fire doors and fire shutters are closed; (b) all oily waste and rubbish has been removed; (c) fire apparatus is in its place and not obstructed; (d) aisles are clear; (e) no cigar or cigarette stubs or burnt matches are about, indicating smoking in toilets, corners or elsewhere; (f) all gas or electric heaters, flatirons, soldering irons, gluepots, etc., have been shut off; and (g) hazardous manufacturing processes have been left in safe condition, the temperature of dryers, annealing furnaces, etc., which continue operating during the night, being noted on all rounds; (h) hazardous materials, such as gasoline, benzine, etc., have been removed from buildings; (i) all sprinkler valves are open; (j) heat is on, during cold weather, in all heated rooms.

The watchman should make notes of violations of these and other rules and report them to the management the next morning. A simple report blank for this purpose is advised and the Inspection Department having jurisdiction may be consulted for its outline.

Rounds should be made hourly during any period (night, Sundays and holidays), when the property is not operating. Day and night rounds are required during operating periods in some industrial properties, where the hazards involved warrant it. In certain industrial properties having severe or unusual hazards half-hourly rounds are desirable. In others conditions may permit bi-hourly rounds.

The watchman should not be a janitor. In a small property, however, where the round does not exceed 30 minutes, he may do other work if it does not take more than ten minutes each hour. Gate duty may be performed during the rest period when the size of the watch force permits.

On examination of "watchman failure," we find that it is a misnomer. In each case blame for the watchman failure can be laid directly in front of management's door. It is high time that management realizes that it takes more than a badge and a flashlight to make a watchman.

As long as management is content with a "hit-or-miss" watch service — poorly selected, supervised, equipped and paid —a place to shelve inefficient or aging employees, the watch service will be more of a hindrance than a help in preventing fires. As long as management is content to have a watch service in name only and fails to hold it in sufficiently high regard to spend money or time to pick, equip, support and instruct the watchman properly, we are going to have serious fires.

Large loss fires occurring as a result of inadequate watchmen are an indictment against management, not the watchman.

The 1943 Fire Loss.

The following preliminary estimate of the fire loss for 1941, 1942, and 1943 has been released by the National Board of Fire Underwriters.

	1941	1942	1943
January	$26,470,000	$35,565,000	$27,733,000
February	26,102,000	30,819,000	33,175,000
March	31,471,000	30,505,000	39,214,000
April	29,330,000	27,960,000	34,241,000
May	25,637,000	23,233,000	29,297,000
June	24,943,000	22,410,000	26,854,000
July	23,698,000	21,000,000	25,016,000
August	24,122,000	19,680,000	29,193,000
September	24,668,000	20,443,000	26,488,000
October	30,833,000	22,621,000	29,661,000
November	23,822,000	24,144,000	31,647,000
December	31,261,000	36,469,000	47,716,000
Total 12 months	$322,357,000	$314,849,000	$380,235,000
Adjusted loss figures	$303,895,000	$314,295,000	*

Aggregate Loss for 28 Years Is Over Ten and a Half Billion Dollars.

1916	$258,377,952	1930	$501,980,624
1917	289,535,050	1931	451,643,866
1918	353,878,876	1932	406,885,959
1919	320,540,399	1933	271,453,189
1920	447,886,677	1934	271,197,296
1921	495,406,012	1935	235,263,401
1922	506,541,001	1936	266,659,449
1923	535,372,782	1937	254,959,423
1924	549,062,124	1938	265,591,231
1925	559,418,184	1939	274,943,000
1926	561,980,751	1940	268,491,347
1927	472,933,969	1941	303,895,000
1928	464,607,102	1942	314,295,000
1929	459,445,778	1943	370,235,000

*The adjusted loss figures, not available until about the middle of the year, may be expected to vary from the preliminary estimates. For several years the adjusted loss figures have been somewhat lower than the preliminary estimates. Owing to the unusual conditions in 1943, however, it is not possible to make predictions as to the final figures.

Firemen in Military Service.

A recent N.F.P.A. survey of paid fire departments in U. S. cities with over 20,000 population reveals that the nation's fire departments have lost one out of eight of their experienced men to the war.

Fire chiefs from 70 per cent of the cities queried reported to the N.F.P.A. that a total of 5540 of their firemen are already in the armed forces, representing about 12 per cent of their authorized effective strength. While approximately one-third of these cities reported that they had been able to employ substitutes to keep up their manpower, a number of the chiefs observed that such replacements were "plenty green" and are frequently below the physical standards usually accepted for fire service. Fire experts estimate that it takes at least three years of training and experience to make a good fireman.

State results of the N.F.P.A. survey follow:

FIREMEN IN MILITARY SERVICE.

Report by States. Cities Over 20,000 Population.

State	No. Cities Reporting Complete Data	Authorized Fire Dept. Strength	No. in Armed Forces	No. Available for Fire Duty	% of Authorized Strength in Armed Service	% of Authorized Strength Available (*including replacement of men in armed service*)	No. Depts. at Authorized Strength
Alabama	5	465	56	448	12.0	96.4	3
Arizona	2	164	39	150	23.7	91.4	1
Arkansas	2	139	34	137	24.5	98.5	1
California	24	5,535	786	4,875	14.2	88.0	8
Colorado	3	527	82	484	15.5	91.8	0
Connecticut	12	1,415	150	1,369	10.6	96.8	5
Delaware	1	181	14	160	7.7	88.4	1
Dist. of Columbia	1	940	99	857	10.5	91.2	0
Florida	3	267	95	239	35.6	89.4	0
Georgia	5	514	112	500	21.8	97.3	2
Idaho	1	41	2	41	4.9	100.0	1
Illinois	22	3,712	384	3,619	10.3	97.5	14
Indiana	15	1,592	135	1,516	8.5	95.1	7
Iowa	8	554	76	527	13.7	95.3	4
Kansas	3	144	22	135	15.3	93.8	1
Kentucky	5	585	72	544	12.3	93.0	3
Louisiana	2	820	118	769	14.4	93.8	0
Maine	3	240	20	191	8.3	79.6	1
Maryland	1	1,491	82	1,482	5.5	99.3	0
Massachusetts	31*	4,885	534	4,498	11.0	92.1	9
Michigan	14	1,318	98	1,261	7.4	95.6	5
Minnesota	5	1,100	172	1,028	15.6	93.5	1
Mississippi	6	202	28	194	13.8	96.0	2
Missouri	5	1,231	58	1,070	4.7	86.9	0
Montana	1	35	4	33	...	...	0
Nebraska	2	398	56	357	14.1	89.7	0
Nevada	1	43	8	43	18.6	100.0	1
New Hampshire	3†	405	64	379	15.8	93.5	0
New Jersey	17	1,634	200	1,423	12.2	87.1	1
New Mexico	1	25	6	25	24.0	100.0	1
New York (exclusive of New York City)	18	1,932	306	1,799	15.8	93.1	6
North Carolina	7	478	82	447	17.1	93.8	3
North Dakota	1	31	5	30	16.1	96.7	0
Ohio	25	3,100	271	2,844	8.8	91.7	10
Oklahoma	3	211	24	202	11.3	95.6	2
Oregon	2	623	167	580	26.8	93.2	1
Pennsylvania	8	3,578	280	3,411	7.8	95.3	2
Rhode Island	4	682	67	632	9.8	92.7	0
South Carolina	1	88	12	85	13.6	96.6	0
South Dakota	1	49	7	42	14.3	85.7	0
Tennessee	5	616	68	607	11.0	98.6	4
Texas	10	1,552	340	1,405	21.9	90.5	4
Utah	1	165	10	143	6.0	86.7	0
Vermont	1	44	13	41	29.5	93.2	0
Virginia	6	897	80	832	8.9	92.6	1
Washington	4	418	47	420	11.2	100.0	4
West Virginia	5	291	28	279	9.6	95.8	1
Wisconsin	15	1,551	127	1,469	8.2	94.5	8
Totals	321	46,908	5,540	43,514	11.8	92.9	118

*Call firemen not included. †Includes some paid call men.

Maintaining Electrical Equipment.

By V. H. Tousley,
N.F.P.A. Electrical Field Engineer.

In the entire field of fire prevention there is no more important activity today than the maintenance of those industrial plants engaged in the production of the necessities of war; and in the prevention of fires in these industrial plants electricity must be given paramount consideration. It is an established fact that in factories the record of past years has indicated that one fire in every five is of an electrical nature, but with the exigencies of war this normal record has been exceeded. Today approximately one fire in every four in an industrial plant has an electrical cause.

The problem of electrical maintenance becomes one of foremost importance in the industrial field because of the demands of our government that motors and other electrical apparatus be loaded to the utmost, the twenty-four hour operations where the usual rating and cooling-off period for electrical apparatus is omitted, the manufacturing demands whereby electrical installations must be made or remade overnight, the scarcity of critical materials and manpower whereby many of the electrical installations that are made do not have the benefit of our previous standard materials nor care of installation, and the handling of electrical equipment by those not previously trained in safe electrical operation.

The war slogan "Wear It Out; Make It Do; Do Without" that was so generally referred to at the start of this war, is not applicable to the factory. We cannot afford to "wear it out," nor can we afford to "do without," we must "make it do," and proper maintenance is the only means of "making it do."

Today no activity in electrical fire prevention will pay better dividends than an unusual effort aimed at safety to life and property in the maintenance of the electrical equipment of the industrial plant.

The International Association of Electrical Inspectors (Member N.F.P.A.) early recognized the importance of this subject, and appointed a committee to make recommendations for a guide to electrical maintenance. This guide, printed below, has met with a very enthusiastic acceptance and its helpfulness in maintaining the safety of electrical equipment of our essential industries has been generally acknowledged.

A GUIDE TO EFFECTIVE ELECTRICAL MAINTENANCE.

GENERAL.

Effective maintenance of electrical equipment begins with proper application and correct installation. Manufacturers' bulletins describing specific items of equipment are usually the best guides to proper application. The National Electrical Code is the accepted standard for safe installation.

The purpose of maintenance is to *prevent* the occurrence of trouble in electrical equipment. This is best accomplished by preparing a regular maintenance schedule, covering all equipment, and following it closely.

The following paragraphs provide a general guide for the maintenance of electrical equipment. More frequent inspections may be required for equipment in dirty or damp locations, or for equipment subjected to severe loading conditions. Wherever possible, obtain the specific maintenance instruction sheets accompanying each piece of equipment and follow their recommendations.

SUBSTATION EQUIPMENT.

Transformers.

Test temperatures of transformers operating at full load at least once a month. Oil temperature of oil-immersed self-cooled transformers should never exceed 90 Centigrade, and such transformers should not be permitted to operate for long periods of time above 80 Centigrade.

Check oil level in transformers every three months and replace leakage and evaporation loss. Inspect for oil leaks in transformer tanks. Check ground lug and ground circuit.

Condition of transformer oil should be tested at least once each year. If the dielectric strength

is less than 18 kv, oil should be reconditioned. New oil should be tested before being placed in transformer and should have a dielectric strength of at least 18 kv.

Lightning Arresters.

Inspect all lightning arrester connections in early spring just before lightning season and every other month during summer. Measure ground resistance just before lightning season begins; if it exceeds five ohms, make necessary improvements to lower it to five ohms or less. Never run ground wire through iron or steel pipe for protection against mechanical injury unless wire and pipe are bonded together.

WIRING.

Wires and Cables.

Wiring systems subjected to vibration should be inspected monthly. All mechanical connections, such as locknuts, bushings, etc., should be tightened. Bond wires and ground connections should be checked. Check system to make certain that no hazards have developed since last inspection, such as oil or water leaks near raceways, steam pipes installed near cables or raceways, high temperature conditions developed in vaults or special rooms, etc. Examine all wiring in switch boxes, motor connections, etc., for possible mechanical injury. Where vibration is not present, this inspection should be made annually.

Examine drop cords and portable cables every three months when in regular use. Repair any damage or severe wear such as found at point where wire enters lamp sockets, plugs, and portable appliances. Keep extension cords away from radiators, steam pipes, nails, hooks, and other metal objects. Keep rubber cords out of sunshine as much as possible, and free of oil, grease and chemicals. Keep lamp guards in place.

Switch Boxes, Panel Boxes, etc.

Inspect all metal boxes of the wiring system monthly. (In locations that are particularly dusty, boxes should be cleaned out weekly.) Make certain that all covers fit tightly and are in place; keep all unused "knockout" holes plugged tightly. Bond wires and ground connections should be checked.

Fuses and Switches.

Inspect all fuses twice each year to ascertain that circuits are not overfused. Keep fuse clips clean and tight, and check all connections to prevent overheating. Inspect closely for any evidence of overheating as a result of high resistance contacts or overloads. Examine refillable fuses, replacing charred cases, making certain that cases are refilled with links of proper rating, and that fuses are assembled tightly.

Inspect switches at same time fuses are checked. Inspect closely for evidence of overheating as a result of high resistance contacts or overloads. Check operation of "quick-break" features, etc.

LIGHTING EQUIPMENT.

Need for Regular Maintenance.

Lack of maintenance of lighting equipment may reduce available light by as much as 50 per cent or more. This loss represents a loss in investment, increased operating expense, and may cause accidents and production loss. Type of maintenance schedule needed will vary widely with type of plant and size of installation, but it should include the following five-point program:

1. Provide easy access to all luminaries.
2. Clean luminaries regularly with soap and water.
3. Replace lamp outages promptly.
4. Paint walls and ceilings light colors and keep them light.
5. Maintain rated voltage at luminaries.

CONTROL EQUIPMENT.

Keep Equipment Clean.

In dusty locations clean and blow out all starting switches, compensators, controllers, and air circuit breakers at least weekly. Do not allow dust or dirt to accumulate on high voltage bushings or terminals. Do not permit an accumulation of dirt, oil, grease or water on the operating parts of control equipment. In damp or corrosive atmospheres, paint control parts quarterly or semi-annually. In clean locations semi-annual cleanings will suffice.

Check Mechanical Conditions.

The mechanical condition of all control equipment should be checked weekly if subject to vibration, or monthly otherwise. Tighten all nuts and screws, examine electrical and mechanical connections on both panels and resistors. Check condition of "pigtail" connections closely—especially in corrosive atmosphere. Replace any damaged or worn parts, and inspect condition of magnet contact surfaces. See that control mechanism operates freely, and oil or grease if necessary. *Do not lubricate contact surfaces!* Check operation of mechanical or electrical interlock devices.

Maintain Contacts.

Control equipment subject to severe operating conditions should have contacts inspected weekly. A monthly check is sufficient for average operating conditions. Adjust, file clean, or renew contactor tips if badly worn or burned. (Ordinary roughening of contact tips due to arcing need not be serviced, but large projections should be removed with a file. If there is evidence of overheating, oxide surface should be removed by a few strokes with a file.) Examine closely for any high resistance joints in

contactor circuit. (A new combination a-c/d-c millivoltmeter is available for checking resistance of bolted joints and contact surfaces.) Do *not lubricate contact surfaces.*

Check Oil Condition.

Make semi-annual inspection of oil level and condition in starting compensators, oil switches and circuit breakers. Replace leakage and evaporation loss; replace oil if dirty or gummy. (In dirty or damp location, inspect oil level and condition quarterly or monthly according to severity of conditions.)

Test Overload Devices.

Circuit breaker tripping points should be checked monthly. Replace dashpot oil if thick and gummy. Keep orifices in plunger clear. Keep leather bellows soft and pliable with neat's foot oil. Be sure that heater coils for thermal overload relays are the correct size. Check overload relay settings every six months.

MOTORS.

Follow Specific Instructions.

Wherever specific maintenance instructions for a particular motor are available, they should be followed closely. In the absence of such specific instructions, the following periodic checks should be made. These are based on average conditions with regard to severity of duty and dirtiness of location. The frequency of the inspections can be varied to suit actual plant conditions.

Weekly Inspections and Operations.

1. Examine commutator and brushes.
2. Check oil level in bearings, but do not over-lubricate.
3. See that oil rings turn with shaft, and note any excessive end play in shaft.
4. See that shaft is free of oil and grease from bearings.
5. Examine starter, switch, fuses, and other controls, as well as ground connections and motor leads.
6. Open-type motors in dusty locations should be blown out thoroughly.
7. Check air gap between rotor and stator. The difference in width of gap around circumference will indicate extent of wear on bearings. This check should be made weekly on motors operating with excessive belt tension; otherwise check air gap semi-annually.
8. Start motor and see that it is brought up to speed in normal time.
9. Check motor and bearing temperature under actual load conditions by feeling with hand.

Semi-annual Inspections and Operations.

1. Clean motor thoroughly, blowing out dirt from windings, and wipe commutator and brushes.
2. Inspect commutator clamping ring.
3. Check brushes and renew any that are more than half worn.
4. Examine brush holders and clean them if dirty. Make sure that brushes ride free in holders.
5. Check brush pressure.
6. Check brush position.
7. Drain, wash out, and renew oil in sleeve bearings.
8. Check grease in ball or roller bearings.
9. Check operating speed or speeds.
10. See that end play of shaft is normal.
11. Inspect and tighten connections on motor and control.
12. Check current input and compare with normal.
13. Run motor and examine drive critically for smooth running, absence of vibration, worn gears, chains, or belts.
14. Check motor foot bolts, end-shield bolts, pulley, coupling, gear and journal setscrews, and keys.
15. See that all motor covers, belt and gear guards are in good order, in place, and securely fastened.

Annual Inspections and Operations.

1. Clean out and renew grease in ball or roller bearing housings.
2. Test insulation by megger.
3. Clean out magnetic dirt that may be hanging on poles.
4. Check clearance between shaft and journal boxes of sleeve-bearing motors, to prevent operation with worn bearings.
5. Clean out undercut slots in commutator.
6. Examine connections of commutator and armature coils.
7. Inspect armature bands.

Complete Overhauls.

Motors should generally be given an overhauling at intervals of five years or so, normally, or, if the service is more severe, more frequently. Such a practice is beneficial in avoiding breakdowns and in extending the useful life of the equipment.

ARC WELDING SETS.

Special Considerations.

The general maintenance schedule relating to motors and motor controls will apply generally to arc welding sets. Ground connections should be checked periodically. Condition of cable leads should be inspected frequently to prevent flow of short circuit current, which may load generator over a long period of time. Proper ventilation should be provided, and machines operated outdoors should not be covered with tarpaulins in such a way as to impede ventilation.

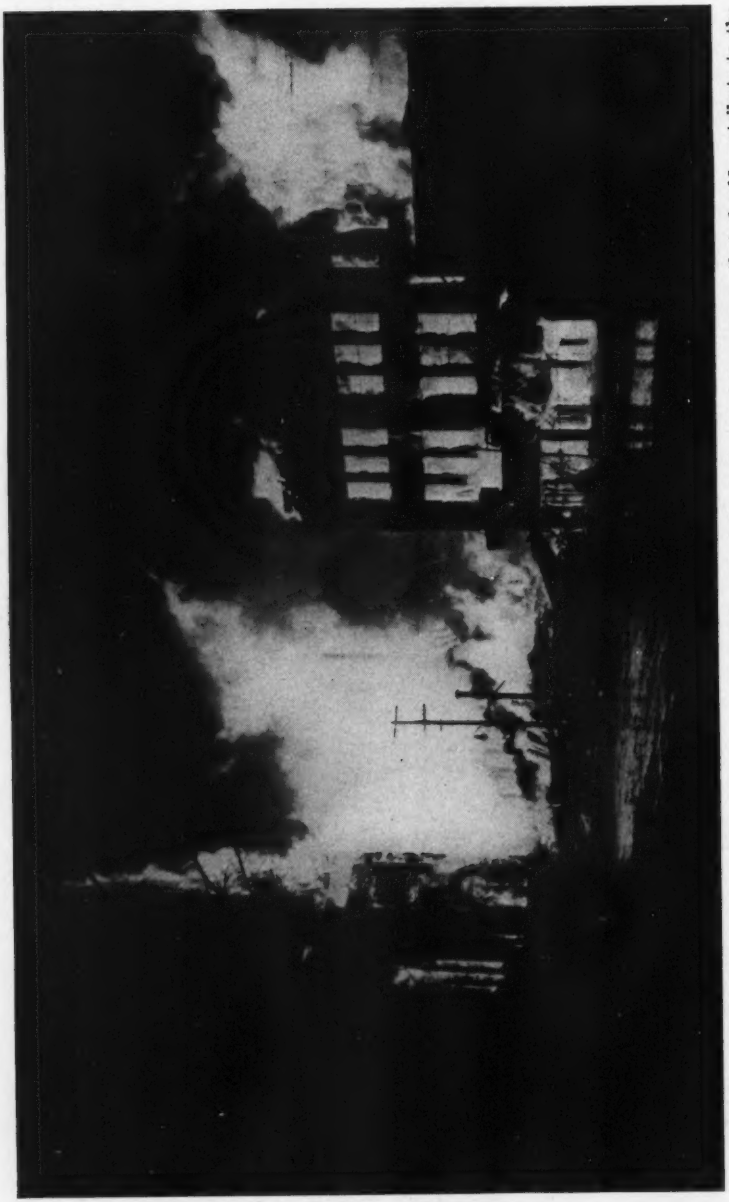
Large Loss Fires of 1943.

During 1943 there occurred in the United States and Canada a total of one hundred and five fires, each of which resulted in a loss of $250,000 or more. One hundred and three persons lost their lives in these fires. This information is based upon reports received by the N.F.P.A. Department of Fire Record and is not necessarily complete. Nine of these fires occurred in Canada. The 1943 record of 105 large loss fires represents an increase of twenty-five fires, or thirty-one per cent over the number reported in 1942, and it should be noted that the eighty fires reported in 1942 was sixty-seven per cent increase over 1941. The quadruplication of large fires during the past five years as shown below is a matter worthy of the utmost concern to a nation at war.

1939	28 fires
1940	38 fires
1941	48 fires
1942	80 fires
1943	105 fires

The following table shows the occupancies which were involved:

Warehouses	16
Metal workers	11
Army and Navy property	9
Group fires	9
Miscellaneous manufacturing	7
Multiple occupancies	7
Chemical plants	5
Cotton seed and soy bean oil mills	3
Flour and feed mills	3
Rubber workers	3
Department stores	2
Fertilizer plants	2
Gasometers	2
Railroad property	2
Wineries	2
Woodworkers	2
Apartment house	1
Cannery	1
Chicken hatchery	1
Coal mine	1
Conflagration	1
Forest fire	1
Garage	1
Grain elevator	1
Hotel	1
Laundry	1
Meat packer	1
Oil refinery	1
Ore refinery	1
Paper mill	1
Sawmill	1
School	1
Shipyard	1
Textile worker	1
Theatre	1
Yacht yard	1



Day by day and night by night, fires large and small take their toll of life and material resources that should contribute to the war effort. Careless fire is just as destructive as enemy bombs. This fire, in Plymouth, N. H., on the night of Jan. 5, 1943, destroyed several buildings and important contents with a loss of $310,000.

Factors Responsible for Large Losses.

Following is an analysis of the factors responsible for the large losses. In every fire several factors contributed to the rapid spread of the flames and the excessive loss.

	No. Times Contributing
Structural Factors.	
Inferior construction, excessive areas, etc.	67
Lack of sufficient exposure protection	20
Unprotected vertical openings	22
Occupancy Factors.	
Highly flammable contents, excessive amounts of burnable stock	40
Flammable liquids and gases	22
Unsafe heating equipment	2
Contents of unusually high value	4
Fire Protection.	
Lack of adequate private protection	79
Lack of fire doors or cut-offs between sections	22
Fire doors blocked open or otherwise inoperative	4
Lack of adequate public fire protection	12
Sprinkler system shut off	4
Sprinkler piping obstructed	1
Gravity tank frozen	1
Fire Fighting.	
Fire difficult of access	15
Poor fire fighting	4
Fire department inadequately manned or equipped	8
Inexperience in fighting fires of such magnitude	5
Fire department delayed	4
Delays in Giving Alarm.	
Headway of fire when discovered	33
Efforts made to extinguish fire without giving alarm	6
Watchman became confused	3
Water Supplies.	
Inadequate water supply	22
Shortage of hydrants	10
Lack of approaches to static water supply, such as river, pond, etc.	1
Failure of fire pump	1
Weather Conditions.	
Strong wind	6
Low humidity	1
Extreme cold	5
Explosions	17

Large Loss Fires of 1943.

Jan. 1, Stamford, Conn. Group Fire. Loss: $250,000.

Fire of undetermined cause started about 2 A.M. in the cellar of an unsprinklered two-story brick-joisted building housing stores, offices and apartments. Flames communicated to a second similar structure, 4 stories in height, but were prevented from damaging a third building by a fire door. Blaze was brought under control by the use of thirteen hose streams.

Jan. 2, Los Angeles, Calif. Canneries. Loss: $1,000,000.

Fire starting in a pile of fish meal, probably due to spontaneous heating, destroyed two sardine canning plants in San Pedro working almost exclusively on government orders. Quantities of flammable fish oil and the old wooden construction of the two canneries were contributing factors in the rapid spread of the flames. Thirty thousand cases of packed sardines for delivery on military contracts were destroyed. Loss estimated at from $700,000 to $1,000,000.

Jan. 2, Meridian, Miss. Wallboard Factory. Loss: $300,000.

Following a very small fire in a dryer a severe explosion occurred, wrecking the furnace enclosure and severely damaging the dryer building of the Flintkote Co. The explosion was due to the delayed ignition of gas fuel which had continued to flow due supposedly to the failure of an automatic shut-off valve, and had accumulated in the upper portions of the dryer and heating duct system following the fire. A four-inch gas main under 30 lbs. pressure was broken and burned as a huge torch under the roof until shut off. Seventy-eight sprinklers operated and brought the resulting fire under control. Loss to property: $50,000; interruption to production, $250,000.

Jan. 5, Plymouth, N. H. Group Fire. Loss: $310,000.

A fire started near the boiler room in the basement of an unsprinklered three-story brick and frame building occupied by stores and offices. A "hot air explosion" occurred almost immediately, spreading the flames throughout the structure. The one-story frame Methodist Church only 20 feet away became involved and was destroyed in addition to a near-by warehouse, a bakery and a coal shed.

Jan. 7, St. Louis, Mo. Paint Factory. Loss: $415,100.

A night watchman discovered fire in the elevator shaft on the third floor of the four-story brick-joisted paint factory of the Mound City Paint and Color Co. Flames traveled swiftly through unprotected floor openings and com-

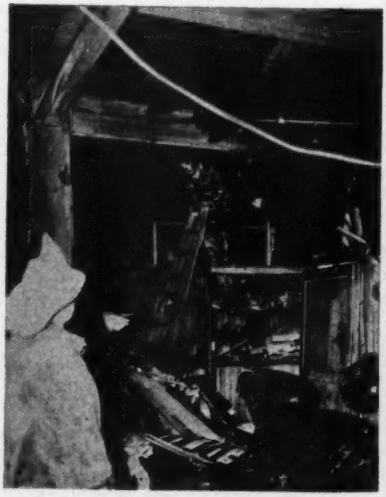
several buildings and important contents with a loss of $310,000.

This St. Louis paint factory burned on January 7 with a loss of $415,100. Without sprinklers or other automatic fire protection, the building was doomed once fire started in the flammable paint materials.

municated to and destroyed a warehouse building separated from the paint factory by a standard fire wall. The fire doors in the wall were closed, but were not tight enough to prevent the passage of burning paint or flammable vapors. Paints, naphtha thinner, acetone and benzol burned so furiously that the firemen could not enter the building on their arrival within a very few minutes after the start of the fire, and 23 pieces of fire apparatus could not prevent a total loss. There were no automatic sprinklers or other automatic fire protection in the building.

Jan. 7, Memphis, Tenn. Department Store. Loss: $336,000.

Fire started at 2 A.M. on the eighth floor in the advertising department of J. Goldsmith and Sons Co. An electric heater may have been responsible, though employees stated that all heaters were turned off. The automatic sprinklers operated, and the fire department, summoned by a central station sprinkler supervisory system, arrived promptly. The sprinkler system was of the dry-pipe type. Some sprinkler heads at the end of branch lines over the point of origin of the fire were clogged by scale and sediment, which could have been due to alternate wet and dry operation of the system at some previous time, a practice not recommended by the N.F.P.A. standards. Other sprinklers wet down combustible materials around the fire and restricted its spread. The fire did not extend below the eighth (top) floor, but the floors were not waterproofed or drained, and water from 168 sprinklers had already



The J. Goldsmith and Sons Co. department store, Memphis, after the fire of January 7.

soaked merchandise as far down as the fourth floor when the firemen arrived. Salvage covers were spread over merchandise on all the lower floors, which reduced the damage due to water from hose streams and sprinklers. The contents valued at $1,350,000 were damaged to the extent of $200,000, and the building, valued at $1,275,000, was damaged to the extent of $100,000. Loss of business during the nine days following the fire when the store was closed was estimated at $36,000.

Jan. 7, Mayfield, Ky. Enterprise Tobacco Warehouse. Loss: $275,000.

A huge single-story unsprinklered brick-joisted tobacco warehouse was destroyed by a fire of unknown origin. One employee lost his life when he attempted to salvage some personal property and was overcome by heat and smoke. Several hundred hogsheads of tobacco and some twenty-five tons of loose leaf tobacco were destroyed. The fire was well advanced when discovered by an outsider at 3:30 A.M., and when the fire department arrived more than half of the warehouse was involved. Because the building was a single fire area there was little to be done beyond protecting exposed property.

Jan. 8, Montreal, Que. Seed and Fertilizer Plant. Loss: $386,310.

Fire of undetermined cause started in the mincing roof on the second floor of this third class, unsprinklered building of Canada Packers, Ltd. Several explosions occurred, causing the flames to spread rapidly through the structure. Lack of sufficient hydrants near the plant handicapped the firemen, who had to chop holes in the ice of a near-by canal to obtain adequate water supplies with which to quell the blaze.

Jan. 14, East Sidney, Ohio. Machine Shop. Loss: $576,877.

An old brick-joisted building, 40 ft. wide and 525 ft. long, formerly a meat packing house, was occupied by the Copeland Refrigerator Corp. as a plant for the manufacture of airplane carburetors. A thousand feet beyond the city limits, there was no water supply for fire protection, except that a ramp had been constructed on the bank of the near-by river, so that a fire department pumper could take suction from the river. No explanation has been given as to why an important war contract had been given to a plant of combustible construction so lacking in fire protection. No Army security inspector had visited the plant prior to the fire.

Employees complained of excessive heat about noon, and shortly after 1 P.M. fire was discovered in an unoccupied attic space. The Sidney fire department responded with one pumper and two men (the entire fire department personnel on active duty at the time), but returned without doing any fire fighting, as the officer in charge stated that there was not sufficient hose to reach the nearest hydrant 1800 ft. away, that the ramp to the river was unsuitable for use, and that the pumper had no hard suction hose. Employees fought the fire with a garden hose, trying to stop it at a brick wall (not a fire wall). This effort was successful for a time, but after two hours or so the water supply for the garden hose failed due to a broken pipe and the entire plant was practically a total loss except for the salvage value of some of the machines owned by the Defense Plant Corporation (U. S. Government agency).

Part of the ruins of the carburetor plant of the Copeland Refrigerator Corp., near Sidney, Ohio, January 14. After the Sidney Fire Department responded but returned to quarters because of lack of hose, employees held the fire at a brick wall, using garden hose, for two hours until the water supply failed.

Jan. 16, Boston, Mass. Lumber and Veneer Mill. Loss: $350,000.

A welder was working inside a steel tank, repairing it. Employees posted to protect welding operations against fire quit when the whistle blew, and as a result, heat conducted from the tank ignited the adjacent wood floor and partition. The welder and another employee tried unsuccessfully to extinguish the fire after first turning in an alarm. Fire doors failed to restrict the spread of the flames in this large-area frame plant because they were installed in a wooden wall with plain glass windows. No automatic sprinkler protection or private yard hydrants. Mill area was almost completely destroyed and production of special veneer for important war contracts was stopped. Valuable machinery difficult and costly to replace under war conditions has been written off the Palmer and Parker Co. books under their depreciative schedule. It was 53 weeks before full production was resumed.

Jan. 16, Pelham, S. C. Cotton Warehouse. Loss: $275,000.

Fire originating between 4 and 5 A.M. beneath the grade floor of the main warehouse building of the Pelham Mills resulted in the complete destruction of this warehouse property containing a large amount of cotton, silk, rayon and nylon. The fire was discovered about 7:40 A.M. after it had spread to the first floor, which was well filled with baled cotton mill waste, and had reached considerable proportions. The space under the building was unsprinklered, and the fire spread under the entire building out of reach of water from sprinklers which were installed only to protect the floors above. The sprinkler system, installed 45 years ago, did not meet modern standards, had not been well maintained, and lacked an adequate water supply. The sprinklers operated as the fire spread up to the first floor, but were ineffective because fire was then too far advanced. Fire departments from two near-by cities were unable to prevent spread of fire to other storage buildings because no water was available from private hydrants and there were no suitable approaches to river and mill pond.

Jan. 21, Colorado Springs, Colo. Army Property. Loss: $1,000,000.

Fire of unreported cause destroyed twenty-five barracks buildings at an internment camp. The barracks were unoccupied and no one was injured. According to a newspaper account, one of the buildings was blown by high winds against a second structure, an overturned stove starting a blaze that spread throughout the camp.

Jan. 22, St. John, N. B. Group Fire. Loss: $250,000.

Fire, believed to have been caused by a defective flue, started in a bowling alley at 1 A.M. and destroyed a department store and two hotels before it was brought under control. High wind, zero weather, delayed discovery made this fire difficult to fight. An outside sprinkler system operated effectively, preventing the flames from communicating to a near-by bank. Buildings destroyed were all old frame structures with open unprotected windows facing small courts. No automatic sprinklers, automatic fire alarm or watchman service provided. The burned structures were in the center of a congested city block of inferior construction and a conflagration was averted only by efficient work by the city fire department.

Jan. 23, Naples, N. Y. Winery. Loss: $500,000.

Fire which reportedly started in a dryer resulted in the destruction of a three-story tile and stucco grape juice building, brick wine cellar, power house, plumbing shop and several sheds of Widmer's Wine Cellar, Inc. Irreplaceable machinery was lost.

Jan. 27, Marion, Va. Group Fire. Loss: $1,250,000.

A large woodworking plant engaged in filling orders for airplane parts, a church and several dwellings were destroyed by fire which

A huge quantity of film being processed for Army use was destroyed in this $253,000 fire, St. Louis, February 3.

started in the main finishing area on the second floor of a brick building. Flammable liquids, lacquers, cotton cloth, rubber cement, and other highly flammable materials were present. The highly combustible contents, extreme congestion, and large area of the room of origin caused a great many sprinklers to operate and the single source of water supply from city mains did not furnish sufficient water for the sprinkler system, which was not designed for such a high hazard occupancy. Flames quickly communicated to other structures, as there were no cutoffs or clear spaces between the buildings.

Feb. 3, St. Louis, Mo. Photographic Film Plant. Loss: $253,000.

Fire of unknown cause occurred in the vicinity of rolls of unsensitized nitrocellulose stock as well as cellulose acetate "safety" film stored in a receiving room located at the south end of the basement of the Hammer Dry Plate Co. building. Minor explosions were heard at the time of discovery and continued intermittently during the early stages of the fire. Thirty public hose streams were brought into operation to quench the blaze. No automatic sprinkler protection provided, although such protection had been recommended. Storage of nitrocellulose film not segregated or safeguarded by standard methods. Damage to building and contents was heavy. Vertical openings were unprotected.

Feb. 12, Hagerstown, Md. Fertilizer Plant. Loss: $250,000.

Fire of undetermined origin destroyed the large three-story frame factory of the Central Chemical Co. engaged in the manufacture of fertilizer. The plant was not sprinklered and there were no fire hydrants within 1200 feet of the building. The fire was beyond control of first aid appliances when it was discovered by employees, who called the local fire department. The fire spread rapidly through unprotected vertical openings and the fire department was able to save only a portion of the building, which was of semi-incombustible construction. Property damage exceeded $200,000 and indirect losses brought the total loss to $250,000.

Feb. 13, Dawson Creek, B. C. Business Block. Loss: $600,000.

Fire of unknown origin broke out in a construction company garage and had been practically brought under control by Army and town fire fighters when a terrific dynamite explosion occurred, killing five persons and injuring many others. Fire department equipment was temporarily put out of commission by the blast, which threw burning débris over six business blocks. A high wind also aided in spreading the flames. With the help of a bucket brigade the fire was finally brought under control. It is reported that the U. S. Government has paid $400,000 in claims for property damage and nearly $200,000 has been paid by underwriters

This rubber warehouse, North Kansas City, Missouri, burned on February 17, destroying a large quantity of tires and other products. Loss: $540,000.

in personal injury claims. The British Columbia County Court levied a $10,000 fine against the contractor, the Miller Construction Co., for criminal negligence.

Feb. 16, Poughkeepsie, N. Y. Windsor Hotel. Loss: $275,000.

Fire, originating in an air shaft, resulted in the virtual destruction of a five-story unsprinklered brick-joist hotel. Stores located on the ground floor were severely damaged by smoke and water. It is reported that the airshaft, where the fire started from an uncertain cause, contained accumulated rubbish to a depth of about four feet. The airshaft communicated to the open loft spaces located at the roof and also between the third and fourth floors, which was the original roof level. Sub-zero weather hampered fire fighting operations.

Feb. 17, North Kansas City, Mo. Rubber Warehouse. Loss: $540,000.

A building housing a rubber tire warehouse and a tire recapping plant was completely destroyed by fire of unknown cause, which originated near the center of the building. The structure was one story brick joisted, with a total undivided area of 51,200 square feet. No sprinklers. No watchman service. Fire was beyond control when the first apparatus arrived promptly on receipt of an alarm at 1:57 A.M. The North Kansas City Development Co., owners of the buildings, had proposed the installation of automatic sprinklers to the Goodyear Tire and Rubber Co. and the Kelly Springfield Tire Co., which rented the building, but no action had been taken, presumably due to War Production Board restrictions on sprinkler installations.

Feb. 18, Seattle, Wash. Packing Plant. Loss: $560,000.

A Boeing test bomber hit a high tension wire and crashed into the fourth floor of a frame building of the Frye Packing Co. A terrific explosion occurred and the building was heavily damaged by the resulting fire. Eleven occupants of the bomber and eighteen employees of the packing plant were burned to death. Later, while firemen were overhauling the ruins, escaping refrigerant gases caused the death of a fireman. Plant fire brigade and Coast Guard aided the fire department in bringing the flames under control.

Feb. 18, Bishopville, Md. Chicken Hatchery. Loss: $300,000.

Fire of electrical origin, which spread through a huge open ceiling space, destroyed a single-story concrete block and frame building containing thirty-three hatcheries, over two million eggs and about sixty thousand chickens. Fire companies from Bishopville, Berlin, Selbyville, Trankford and Millsboro fought the blaze.

Feb. 23, Saginaw, Texas. Flour Mill and Elevator. Loss: $1,930,603.

A severe dust explosion, occurring in the vicinity of the unloading shed, demolished several mill buildings of the Burrus Mill and Elevator Co. Resulting fires ignited the wood roof of a warehouse which collapsed on top of the stored grain, breaking off the water supply line to the partial sprinkler system, which had been installed only to protect part of the property because the structures were largely "fireproof." Fire on the roof was inaccessible for fire fighting because first explosion had blown away the ladder and lift. Inadequate ventilation of a hazardous dusty area was the probable cause.

The Snow Shipyard, Rockland, Maine, burning on February 25.

Feb. 25, Rockland, Maine. Shipyard. Loss: $750,000.

Fire of unknown origin completely destroyed one of the major building units of the Snow Shipyards, Inc., engaged in the construction of auxiliary vessels for the U. S. Navy. Fire damage resulted in serious production delay. Plant consists of a large number of buildings entirely of frame construction occupying an area of about eight acres. Entire plant is one fire area and almost entirely without private fire protection facilities. Building where the fire occurred was two-story frame and occupied by a machine shop, plate shop, boiler shop, supply room, electrical shop and garage. Fire department found the building beyond saving upon their arrival.

Feb. 26, Delaware Township, N. J. Bus Garage. Loss: $560,000.

A garage and bus repair shop of the Public Service Coördinated Transport Co. was totally destroyed by fire which started in a bus which had just been cleaned and filled with gasoline. Twenty-eight buses were destroyed. Fire departments of Haddonfield, Ashland, Erlton and Lawnside coöperated in fighting the fire. Upon their arrival they found the building completely involved. When the fire occurred, the 45,000-gallon sprinkler tank was out of commission as the result of freezing.

The Albers Bros. Milling Co. fire, Oakland, California, February 28. Loss: $2,098,691, plus loss due to interruption of operations.

Feb. 28, Oakland, Calif. Albers Bros. Milling Co. Loss: $2,098,691.

Fire of unknown origin started in the warehouse 840 feet long by 165 feet wide of a waterfront grain mill. Flames spread rapidly through the entire plant fed by accumulations of grain dust. Unprotected vertical openings and blocked fire doors were contributing factors to the quick spread of the fire. Wired glass windows melted from the heat. Oakland fire department was hindered in reaching the scene by sightseers blocking the only road to the plant. City water supply was also inadequate for this conflagration, only two hydrants connected to an eight-inch dead end main being available. Loss of $2,098,691 does not include loss due to interruption of operations.

Mar. 1, Bristol Twp., Pa. Chemical Plant. Loss: $250,000.

The Rohm & Hass Chemical Co., a three-story plant of non-combustible construction and engaged in the manufacture of gun turrets and plastic noses for airplanes, was badly damaged

Hogarth.

Huge quantities of groceries and meats were destroyed in this fire in Wilkes-Barre, Pa., on March 23, when fire started from a short circuit in electric wiring in an office. Fire spread up an unprotected elevator shaft and quickly involved the entire building. Built in 1879, the wooden interior was tinder dry and lacked automatic sprinklers or any barrier to the spread of fire. Loss: $317,790.

by fire which started with the explosion of a mixing kettle due to an uncontrolled chemical reaction. A second explosion of flammable vapors did extensive damage, but did not break sprinkler pipes. Three men lost their lives. Fire doors operated effectively to save half the building. Four volunteer fire companies, aided by the plant fire brigade, used fifteen hose streams to bring the blaze under control. Sprinklers could not extinguish the fire in the burning chemicals, but kept the fire in check and prevented much greater structural loss.

Mar. 6, Richmond, Cal. School. Loss: $300,000.

An incendiary fire which started almost simultaneously on all floors of this three-story school building with hollow tile walls, spread throughout the structure by means of open stairways. The fire is believed to have been burning for more than an hour before discovered by a passer-by, and the entire building was involved when the alarm was received by the fire department.

Mar. 7, Little Rock, Ark. Swift & Co. Cotton Seed Oil Mill. Loss: $250,000.

Fire started in the linter room in the vicinity of a cooker machine, presumably due to spontaneous ignition of oily materials, and destroyed a two-story brick and plank on timber cottonseed oil mill. Flames spread through unprotected openings in the oil-soaked walls. The sprinkler system is believed to have been shut off at the time of the fire. It is reported that the property had not been inspected by any insurance inspector since 1934, at which time there were so many unsprinklered areas that the property was rated as unsprinklered. The fire department was handicapped by inadequate water supply from yard hydrants.

Mar. 10, Green Island, N. Y. Warehouse. Loss: $470,000.

A workman was using an electric welding outfit to thaw out a frozen pipe in an old two-story frame building used for the storage of baled hemp, flax, rags and machinery. Flash fire occurred, igniting the hemp piled eleven bales high. About 1880 tons of hemp, covering an area 100 x 90 feet, and approximately 112 tons of flax, were stored in the fire area. Aisle space was inadequate and other features were not in accordance with N.F.P.A. Standards for the Storage of Combustible Fibres. Although sprinklers operated promptly, the crowded storage made it impossible for them to extinguish the fire. Water supply to sprinklers was inadequate after the fire department placed six hose streams in operation. Building walls collapsed when water swelled the bales of hemp. Loss to building: $30,000; contents valued at $440,000 were heavily damaged.

Mar. 12, Marion, Ind. Wire and Cable Plant. Loss: $395,000.

This fire in the plant of the Paranite Wire & Cable Corp. interrupted production of important war materials. The fire started in a pile of crude rubber and spread rapidly through unprotected vertical openings. Recognizing the hazard a year before the fire, the company had contracted for the installation of automatic sprinklers and hydrants on one side of the building where additional protection was needed. However, it is reported that this installation was not made because the War Production Board refused priorities for the necessary pipe. The absence of this protection was directly responsible for the large loss. A contributing factor was that the alarm was delayed while workmen tried unsuccessfully to put the fire out with two extinguishers.

Mar. 13, Selby, Calif. Ore Refinery. Loss: $250,000.

San Francisco Chronicle.

Fire of undetermined cause occurred in a sample room and spread to an acid plant and several other closely built frame structures of the American Smelting and Refining Co. Buildings were unsprinklered. Plant was engaged in vital war work, involving the smelting of gold, silver, lead and copper and the manufacture of bluestone and sulfuric acid. Workman tried to put out the blaze with a fire extinguisher, delaying the alarm. Fire spread into concealed areas between walls and in the attic, making fire fighting difficult. Broken water lines caused interruption of hose streams until valves were closed and lines switched to other hydrants. The frame building had no fire stops. Reports

Nine thousand bales of jute, part of the government stock pile of critical materials, was badly damaged in this New Bedford, Mass., warehouse fire, with a loss estimated at $260,597.

indicate an outstanding job by the chief of the Crockett Fire Department, who was called in to direct joint fire department operations.

Mar. 19, Binghamton, N. Y. Apartment Building. Loss: $250,000.

One woman was trapped and burned to death when flames starting in a third-floor apartment swept through the four-story brick Wilkinson Block. The one stairway was cut off and occupants were forced to either jump to life nets or be carried down ladders to safety. Fire marshal reported at a coroner's inquest that the rapid spread of the blaze was due to wooden interior construction, large open hallways and an air-shaft which acted as a flue. Newspapers estimated the loss at $250,000. Efforts to obtain more specific information have been futile.

Mar. 23, Wilkes-Barre, Pa. Multiple Occupancy. Loss: $317,790.

A four-story brick-joisted building built in 1879, housing a wholesale grocery firm, a wholesale meat company, a packing plant and a grocery warehouse, was totally destroyed with its contents. Fire started from a short circuit in obsolete electric wiring in a first-floor office. Flames spread rapidly through the unsprinklered building via an open elevator shaft.

Mar. 25-30, New Bedford, Mass. Warehouse. Loss: $260,597.

Fire heavily damaged a one-story brick and plank on timber warehouse used for the storage of cotton, jute and wool. The blaze started when an arc from a plug on an extension cord ignited cotton bales. The section where the fire occurred was stored with about 3000 bales of cotton, cotton waste and jute in deep piles divided by narrow aisles, not in accordance with the N.F.P.A. Standards for the Storage of Combustible Fibres. Flames spread rapidly over the baled stock along the aisles and flashed through open fire doors to ignite stock in an adjoining section containing about 9000 bales of government owned jute. Automatic sprinklers operated promptly and held the blaze in check until the fire department could get seven hose streams in operation. The effectiveness of the sprinkler action was hampered by the crowded storage. The swelling bales of jute caused the walls and roof to collapse.

Mar. 31, Cairo, Ill. Soy Bean Oil Mill. Loss: $1,650,000.

The Cairo Meal and Cake Co., a cottonseed oil and soy bean oil mill and a warehouse containing U. S. Government owned wool and peas was destroyed by fire of unknown origin. Fire spread rapidly over the lint-coated structural members of the old frame building and an obsolete sprinkler system proved ineffective, probably due to failure of the fire pump. Responding to a delayed alarm fire apparatus became stuck in the mud near the plant and caused a thirty minute delay in getting hose streams on the fire.

Apr. 16, Baltimore, Md. Rubber Works. Loss: $250,000.

Employees in a rubber plant manufacturing "Cats Paw" rubber heels and other products were handling rubber cement by means of air pressure applied to a drum. The exact circumstances of the cause of the fire are not clear, as two employees were burned to death. It is believed, however, that excess air pressure was applied to the drum and either the drum or connected equipment ruptured, spraying the rubber cement over employees in the vicinity. There was an ordinary electric drop light not of the explosion-proof type immediately adjacent to the equipment and this was considered a probable source of ignition. Automatic sprinklers operated promptly and held the fire in check, but the area was full of smoke and there was great confusion among employees trying to make their escape. One of the officials of the plant ordered the sprinklers shut off and the fire then spread rapidly, but was checked in other sections where the sprinklers were still in operation. Attempts were made to reopen the closed sprinkler valve, but it could not be reached, and when the fire department arrived hose streams were directed into the burning area. Water damage was responsible for a large part of the loss.

Apr. 24, Portage La Prairie, Man. Grain Elevator. Loss: $300,000.

Fire believed due to an overheated bearing severely damaged a grain elevator of metal-clad frame construction. Flames spread rapidly through the structure because of numerous unprotected openings and fire walls of insufficient height. Manpower shortage and an inadequate water supply hampered the activities of the fire department. A number of small fires were started in the vicinity of the elevator due to flying brands falling on wooden shingle roofs.

May 1, North Kansas City, Mo. Metal Worker. Loss: $270,000.

A one-story brick-joisted plant making metal barrels was almost totally destroyed by fire. The blaze was apparently due to spontaneous ignition of residue from Government specification olive drab paint. Plant did not comply with N.F.P.A. standards for spray booths, and there was no automatic sprinkler protection. Fire caused extensive interruption to production. A clerk who had entered the building to investigate the fire was later found burned to death.

May 4, Lamar, Mo. Group Fire. Loss: $300,000.

Fire, originating in burning rubbish, communicated to a one-story frame coal shed, spread across a 14-foot alley to a frame lumber yard, then involved a frame church, and finally ignited two brick and stone mercantile and industrial buildings. The fire was discovered in its incipiency, but a combination of the following factors permitted it to reach conflagration proportions: (1) Delay of from three to five minutes in transmitting the alarm to the volunteer fire department, (2) Delay estimated at about twenty minutes in connecting pumper to hydrant due to corroded hydrant threads, (3) Concentration on an attempt to save the already hopelessly involved church, permitting fire to spread unchecked in opposite direction to the mercantile and manufacturing buildings.

May 4, Laurens, S. C. Glass Bottle Factory. Loss: $300,000.

Fire of unknown cause started among pasteboard cartons in a one-story metal-clad frame warehouse, lacking automatic sprinkler protection and rapidly involved five other warehouses, an annealing building and a crate shop. Although sprinklers operated promptly in three of the other warehouses which were sprinklered, their effectiveness was lessened due to the heavy drain on the water supply by fire departments from three near-by towns using a total of 10 hose streams. This fire again illustrates the fact that automatic sprinkler protection must be complete to be effective, and that limited water supplies cannot supply both sprinklers and hose streams.

May 8, Canton, Ohio. Furniture Warehouse. Loss: $310,483.

Fire of undetermined cause started on the first floor, and spreading through unprotected vertical openings, destroyed a two-story furniture warehouse, which included some incidental manufacturing operations. The building was of non-combustible construction; no automatic sprinklers. Flames also communicated to and destroyed an adjoining building valued at $5000. The fire had gained considerable headway when discovered by a neighbor just before 4 A.M. The night watchman had gone off duty at midnight.

May 11, So. Charleston, West Va. Chemical Plant. Loss: $300,000.

Six men were killed and twenty-four other employees of a synthetic organic chemical plant were injured in an explosion and fire which was caused by an abnormal exothermic reaction within a metal reactor. This plant was of excellent construction, well protected by automatic sprinklers, adequate yard hydrant system and a well-trained and equipped fire brigade. The initial violent rupture of the reactor released quantities of flammable vapor at elevated temperatures, which spread throughout a large area before ignition took place. The resultant explosion caused severe damage to the building, cracking and blowing out the exterior

Cotton valued at $635,000 was destroyed in this Galveston, Texas, cotton warehouse when lightning caused simultaneous fire in two storage sections. The building had neither lightning rods nor automatic sprinklers.

walls. Numerous fires broke out following the explosion, but were brought under control by the fire brigade. The sprinklers operated satisfactorily and performed valuable service in washing flammable liquids out of the building.

May 17, Peoria, Ill. Multiple Occupancy. Loss: $527,000.

Fire of unknown origin destroyed an unsprinklered three-story brick-joist building occupied by several stores, a photographic studio and a department store stockroom. The fire had apparently been burning for some time when discovered at 10 P.M. by a telephone operator in an adjoining department store. When firemen arrived at the scene, flames had spread so rapidly through the combustible stock that the structure was completely involved. Twenty-eight hose streams were used to protect surrounding buildings. Smoke and water heavily damaged the adjoining six-story sprinklered department store.

May 19, Salt Lake City, Utah. Victory Theatre. Loss: $250,000.

Three firemen were killed when the roof collapsed while they were fighting a theatre fire of unknown origin. An adjoining hotel was also damaged heavily.

May 20, Chicago, Ill. Gas Holder. Loss: $1,225,000.

On a rainy, foggy morning when visibility was low, a four-motor bombing plane, attempting to land at the Chicago Municipal Airport, crashed into an all-metal gas holder located about a mile and a half southeast of the airport. All twelve occupants of the plane were killed in the explosion. The wrecked gas holder, reportedly the world's largest, was of the floating piston type, approximately 485 feet in height and 300 feet in diameter. At the time of the crash it contained about 18,000,000 cubic feet of gas. Firemen had to stretch long lines of hose from distant hydrants to extinguish the fire.

May 20, Regina, Sask. Army Property. Loss: $264,300.

A frame building used for storage of Canadian Army supplies valued at $238,000 was destroyed by fire of unreported origin. Due to military secrecy further details are lacking.

May 24, Galveston, Texas. Cotton Warehouse. Loss: $635,000.

Fire caused by lightning destroyed two sections of a cotton warehouse of the Cotton Concentration Co. Priorities could not be obtained for outside protection or sprinkler equipment for this warehouse, which was built in 1942; other previously constructed buildings were sprinklered. No lightning rods were installed. Watchman discovered fire and turned in the alarm over the central station system, but he became trapped and was burned to death. Sixteen hose streams were brought into operation by the Galveston Fire Department. In spite of

high winds fire was confined to the two sections originally involved. Loss has been placed at $635,000, including some $400,000 of Government owned cotton which was not insured.

May 28, Miami, Fla. Mercantile Building. Loss: $500,000.

A two-story concrete and joisted building housing the Red Cross Department Store and other stores was heavily damaged by fire which started in the second-floor storage area, presumably due to careless smoking by employees. Flames had spread considerably through combustible stock before discovery at 11:40 P.M. by a passer-by. There were no automatic sprinklers in the building, no automatic fire alarm, which had been recommended by the Miami Fire Department, and no watchman service. Stairways were enclosed only with frame walls. Servicemen aided seven Miami fire companies in fighting the blaze, which was confined to the building of origin.

May 30, Seattle, Wash. Group Fire. Loss: $682,000.

Three war plants were destroyed by fire caused by the faulty operation of an oil stove used by a watchman of the Nettleton Baldwin Construction Co. A watchman ran to get private hose to fight the blaze, but found the hose disconnected. He did not know the location of the nearest fire alarm box, which was only twenty-five feet from the plant. The watchman was fatally burned. The first alarm received by the fire department was telephoned by a woman who saw the flames. The owners of the property where the fire originated have settled claims against them in the amount of $275,000. These claims were based on their alleged negligence in being in violation of certain fire prevention ordinances and in permitting the fire to spread to other properties.

June 3, Amcelle, Md. Celanese Plant. Loss: $500,000.

A series of explosions of acetone vapors caused severe damage to several building units of a large celanese manufacturing plant. The explosions occurred as the result of an attempt to weld an acetone fume duct without first purging the duct of all flammable vapors. The ducts of the acetone vapor recovery system extended to several buildings, instead of having separate systems for each building, which accounts for the extent of the damage. Provisions made for relief of explosion pressures proved to be inadequate. A total of some 340 sprinklers operated and were very effective in controlling the several fires which ensued. The plant fire brigade is also said to have done excellent work.

June 7, Washington, Ind. Corcoran Metal Products Co. Loss: $474,000.

Fire originated in a quenching tank for refrigerator condensers and radiator cores. The contents of the quenching tank had been changed about five weeks before the fire from an incombustible liquid to an oil with a flash point of 600° F. The blaze heavily damaged the entire processing portion of the plant, which was a one-story structure of 67,000 sq. ft. floor area, not subdivided by fire walls, lacking fire protection other than hand extinguishers. The original floor area had been nearly doubled in 1941. Firemen were delayed in reaching the seat of the fire when they had to wait for someone to bring a key to open the padlocked gate of a heavy wire fence. A weak water supply prevented the fire department pumpers from operating at full capacity. There were no automatic closing covers for the tanks, no provision for a quick draining of the tanks and no automatic fire extinguishing equipment was provided.

June 7, Middle Amana, Iowa. Refrigerator Plant. Loss: $265,000.

An unprotected two and one-half-story brick-joist plant engaged in the manufacture of portable cooling units for the armed forces was destroyed by fire which was set by a pyromaniac. It is reported that equipment already crated for shipment overseas was lost in flames. Fire departments from seven towns fought the blaze.

Ruins of refrigerator plant, Middle Amana, Iowa, after fire, June 7.

June 18, Massillon, Ohio. Flour and Feed Mill. Loss: $300,000.

Fire of undetermined cause started in the vicinity of an elevator and gutted a flour and feed mill of brick-joist construction. The mill lacked watchman and alarm service and was unsprinklered. Alarm was telephoned to the fire department by the plant engineer after he had found it necessary to force the entrance to the mill office. A city fire alarm box within 50 feet of the plant was not used. Firemen had the blaze almost under control when a dust explosion occurred, spreading the flames rapidly throughout the entire structure. Unprotected vertical openings were also contributing factors to the swift spread of the flames. Inadequate manpower handicapped fire fighting activities. Flames soon communicated to the roof of a sprinklered sign plant near by. Sprinklers operated, but were ineffective because of a tin ceiling between the burning roof and the sprinklers. They were also hindered in their operation because five fire department pumpers were using all the available water supply.

July 3, Memphis, Tenn. Chemical Plant. Loss: $300,000.

Fire started with a dust explosion in one of the four cottonseed hull-bran storage buildings at a plant producing furfural for use in the manufacture of synthetic rubber. Owned by the Defense Plant Corp. (U. S. Government agency) the plant was operated by the Q. O. Chemical Co. The buildings were of wooden arch roof construction, 214 ft. long, 100 ft. wide, and 43 ft. high to the top of the arch. The fire may have been caused by the ignition of dust accumulation on an electric light fixture. Flames spread to a second storage section by way of a conveyor bridge connecting the two buildings. Full automatic sprinkler protection in these four storage buildings had been rejected by the War Production Board, but a compromise partial installation had finally been approved. The sprinklers were being installed and would have been in service in about three days. Securing approval for the use of sprinkler materials had resulted in long delays in their installation. The Memphis Fire Department responded promptly, brought the fire under control, and prevented its spread to other buildings.

July 10, McKeesport, Pa. G. C. Murphy Co. Store. Loss: $268,844.

Fire of undetermined cause started in a third floor stock room and badly damaged a three-story brick-joist mercantile building. Watchman at a near-by industrial plant discovered the

Volunteer firemen fighting the night fire in the G. C. Murphy Co. store McKeesport, Pa., July 10. No automatic fire alarm or watchman service was provided for the unsprinklered building. Fire was well under way before it was discovered by a watchman in a near-by industrial plant.

blaze and turned in the alarm. No alarm or watchman service was provided for the unsprinklered structure. Stock was extremely susceptible to smoke and water damage.

July 13, Marysville, Mich. Magnesium Plant. Loss: $325,000.

A large new chemical plant, erected by the Defense Plant Corporation for the manufacture of magnesium, was rapidly nearing completion, and manufacturing units were being placed in operation. The plant, manufacturing magnesium by an electrolytic process, was operated by the Dow Magnesium Corporation, a company experienced in this field and well acquainted with the appropriate safeguards. The buildings involved in this fire employed extensive wooden construction in areas where, in normal times, steel would have been used. The wood was impregnated with asphalt and creosote to retard deterioration from fumes. The fire occurred when the process in one of the units reacted violently and hot molten material came in contact with asphalt-coated woodwork. The extent of this fire may be directly attributed to the improper construction allocated by governmental authorities under the program of conservation of critical materials. The hazard of fighting fires in occupancies handling molten magnesium makes it imperative that this occupancy be located in buildings of non-combustible construction. Although the alarm was given at once and the fire department called, the fire spread rapidly. The plant fire department, together with firemen from Marysville and Port Huron, used hose streams and eventually brought the fire under control. It is important to note that none of the pure pig magnesium which was located on the floor was in any manner damaged by the fire.

July 17, near Atlanta, Ga. Briarcliff Laundry. Loss: $317,000.

Fire of undetermined origin occurred during lunch hour in a laundry dry room on the top floor of a three-story unsprinklered laundry building. The structure consisted principally of skeleton steel with hollow tile walls and concrete or plank floors on unprotected steel. The fire spread rapidly throughout the top floor and by the time the Dekalb County Fire Department pumper arrived, practically the entire top floor was involved. One pumper of the Atlanta Fire Department also responded. Fire fighting was considerably handicapped by an inadequate water supply. The top floor was demolished and a large portion of the next lower floor practically so, due to failure of the unprotected steel columns. Laundry machinery and equipment were destroyed and there was heavy smoke and water damage to furs and garments stored on the lowest floor.

July 18, Pittsburgh, Pa. Fur Storage Vault. Loss: $300,538.

Only forty gallons of water were needed to extinguish a fire which caused more than $300,000 damage to furs and fur coats stored in an air-conditioned vault of the Pittsburgh Fur Service, Inc. It is believed that the furs may have been smouldering for eighteen hours before smoke was detected. The cause of the fire was not determined with certainty, but is believed to have resulted from furs coming in contact with an exposed motor or compressor of the air conditioning equipment. Windows were blocked with plywood and cotton insulation, and the firemen had to work with gas masks.

July 20, Portland, Conn. Yacht Storage. Loss: $300,000.

Fire started in a small cowbarn and communicated to a boat shed on the Connecticut River, destroying almost a hundred pleasure craft. Firemen fought the flames during a severe thunderstorm. Only two hydrants were available near the shed. Coast Guardsmen assisted the fire department by bringing into service a pumper, but the property was completely destroyed.

July 28, New York, N. Y. Welbilt Stove Co. Loss: $250,000.

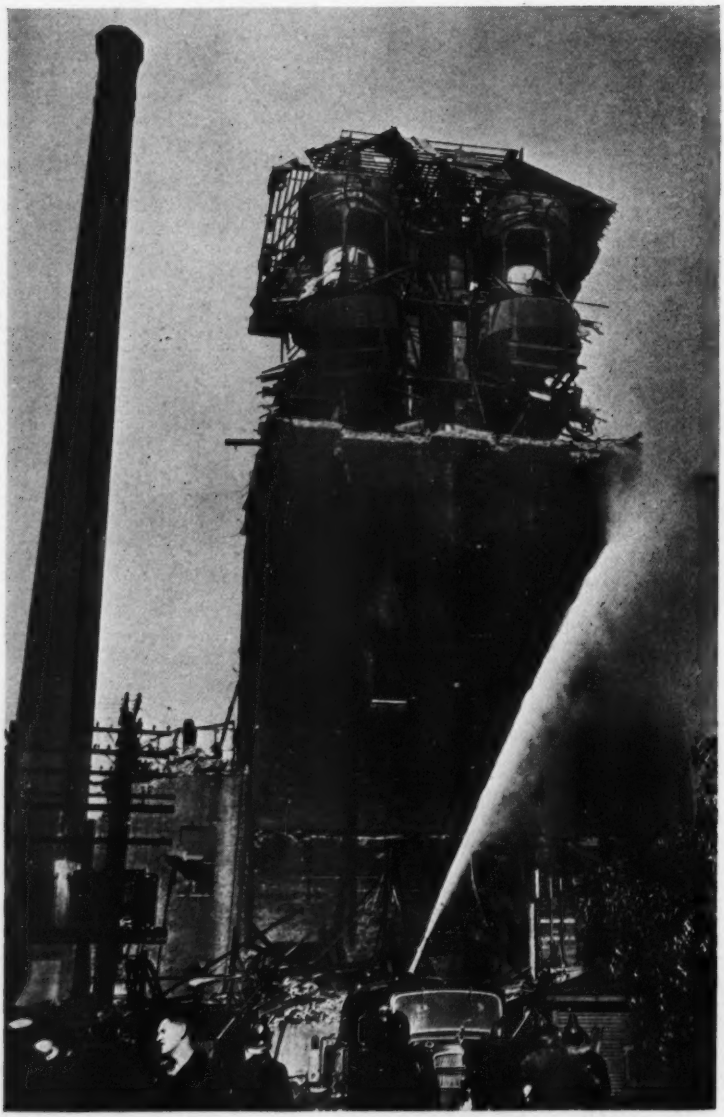
Fire originating in an oven for drying freshly painted metal parts spread to an adjacent dip tank and resulted in damage to building and contents estimated at $250,000. One man was fatally injured by the initial explosion in the oven. Automatic foam system protecting the dip tank operated, but water from hose streams caused japan to overflow and ignite. This was the second serious fire at this plant in six months, considerable damage by fire to another plant building having occurred January 16.

July 28, Praco, Ala. Coal Mine. Loss: $275,000.

Fire of undetermined origin occurred in the main frame tipple of a bituminous coal mine, completely destroying this group of buildings and also some slightly detached buildings. The headway of the fire when discovered, an inadequate water supply and the lack of public fire protection were largely responsible for the large loss.

July 30, Chicago, Ill. Norris Grain Co. Loss: $400,000.

A grain elevator and a soy bean oil extraction plant were wrecked by a dust explosion and fire. The property was one large fire area without cut-offs or automatic sprinkler protection. Originally constructed as a grain elevator, this plant had mainly been used for handling soy beans, for which it was not designed. Seventeen engine companies fought the fire with ten hose streams.



Chicago Sun.

Firemen shown fighting fire which followed explosion in the Norris Grain Company's soybean plant in Chicago on July 30, 1943. This is stated to have been the first major dust explosion recorded in a soybean plant. Three workmen were killed. Note how the brick walls were blown away from the top of the plant. Property was one large fire area without automatic sprinkler protection. Loss: $400,000.

Star-Ledger.

Two views of the ruins of the Congoleum-Nairn plant, Kearny, N. J., after the explosion and fire of August 19. Loss: 12 lives, $2,000,000.

Aug. 7, Wyandotte, Mich. Chemical Plant. Loss: $385,000.

A two-story brick-joisted building equipped for the manufacture of bleaching powder needed in the war effort was practically destroyed by fire of undetermined origin. Plant firemen fought the blaze for twenty minutes before notifying the city fire department. Firemen upon arrival could do little but save near-by structures. There were no automatic sprinklers. A fire wall helped to save the remainder of the plant.

Aug. 17, Great Falls, Mont. Flour Warehouse. Loss: $278,663.

More than 100,000 bushels of wheat were destroyed when fire destroyed a large ironclad flour mill warehouse. Newspapers report that firemen were handicapped in attacking the blaze by an inadequate number of fire hydrants in the vicinity.

Aug. 19, Kearny, N. J. Linoleum Plant. Loss: $2,000,000.

An explosion of solvent vapors killed twelve employees and demolished a part of the Congoleum-Nairn Co. plant. Three cells designed for linoleum drying were being used by a tenant concern for the drying of camouflage materials for the Army. The ventilation was apparently not sufficient to remove naphtha solvent vapors and no adequate explosion relief facilities were provided. Several adjoining sections were destroyed. Automatic sprinkler piping in the immediate area of the explosion was disrupted by the force of the explosion, but the sprinklers helped in preventing spread of fire. The fire department fought the ensuing fire for some five hours.

Sept. 4, Bellefontaine, Ohio. N. Y. C. R. R. Roundhouse. Loss: $900,000.

Sparks from an acetylene torch ignited creosoted wooden interior construction, resulting in a quick-spreading blaze which totally destroyed a newly constructed section of a railroad roundhouse, extended to a machine shop, and damaged twenty-three locomotives. No automatic sprinkler protection was provided. A fire wall saved one section of the roundhouse.

Fire in the refinery of the Pure Oil Co., Marcus Hook, Pa., September 4, caused a loss reported at $350,000. The fire burned for six hours.

Sept. 4, Marcus Hook, Pa. Oil Refinery. Loss: $350,000.

Fire believed due to an overheated electric motor was discovered during the early morning on the third floor of the grease processing building of the Pure Oil Co. This building was of reinforced concrete construction, with brick curtain walls. Upon arrival of the first volunteer fire company the entire building was in flames. All companies in the fire district responded, including a foam truck with four generators and two tons of foam powder. The fire burned for six hours, destroying the entire contents and badly spalling the building. A request to the company for information on the fire was refused because of government regulations.

Sept. 4, Vancouver, B. C. Multiple Occupancy. Loss: $500,000.

Forty firemen were overcome by fumes from demothing liquid while fighting a fire in a three-story unsprinklered brick-joisted building occupied on the first floor by a retail furrier and on the uppers floors by apartments. Although the first alarm was not turned in until 1:17 A.M., tenants in the building had reportedly smelled smoke as early as 9:00 P.M. the evening before. The fire originated in a fur vault and finally spread to the second floor. The vault was insulated with sawdust. The large loss is attributable to the high value of the furs destroyed.

Sept. 7, Oakland, Calif. Group Fire. Loss: $250,000.

A six-alarm fire of unreported origin leveled a block of warehouses and business establishments, caused eight exposure fires and injured several firemen and civilians. The fire started in a warehouse building which had already suffered heavy damage from a fire four months earlier, and quickly extended into an adjoining furniture warehouse. The blaze had gained marked headway by the time the fire department was notified. Following a series of explosions caused by bursting cylinders of refrigerating gas the flames spread with great rapidity, destroying several lines of hose.

Sept. 9, Rockdale, Ohio. Paper Mill. Loss: $587,000.

Fire destroyed a brick-joist and frame mill, which was almost entirely engaged in filling Army and Navy orders for asbestos paper. The plant was located about six miles north of Hamilton, outside the area served by any public fire department and lacked any water supply suitable for fire fighting. Because of legal restrictions the Hamilton and Middletown fire

This fire in Ashland, Ohio, September 24, occurred when a freight train including 23 tank cars was derailed and burning gasoline and oil flowed around the area. A factory producing rubber products for the Navy was burned with a loss of $500,000.

departments were unable to respond when called. A high wind caused the flames to spread rapidly and by the time other small departments reached the scene the fire was beyond control by their limited facilities. The fire, discovered by an employee at 2:15 P.M., is thought to have started at an electric motor.

Sept. 12, Philadelphia, Pa. Broad St. Railroad Station. Loss: $250,000.

A plank train-floor deck, supported by steel columns, furnished the principal fuel for a serious fire at the Broad Street Station. The fire is thought to have originated in a wood sheathed boiler room on the lower level, spread to express offices and storage throughout this area and burned through to the uppper level. The train shed, track platform and several railroad cars were nearly a total loss. This fire emphasized the well-known danger of large wooden plank areas, without automatic sprinkler protection. It was virtually a repetition of a million dollar fire which occurred at the same station on June 10, 1923. In that instance the huge train shed of wood on steel frame construction was destroyed and never replaced.

Sept. 12, Pine Bluff, Ark. Arsenal. Loss: $350,000.

A building in which bombs were stored was destroyed, with a loss estimated at $350,000, including building and contents, as a result of a fire which started when a truck overturned, which was delivering bombs to the building. Further details are not available.

Sept. 17, Norfolk, Va. Naval Air Station. Loss: $250,000.

A mighty blast attributed to the explosion of ammunition in transit killed twenty-five persons, mostly Navy men, and injured some 250 others. The explosion, felt as far as twenty miles away, badly damaged several airplane hangars, destroyed and damaged several planes and demolished two barracks buildings and a storage building. Fires were started, which added to the confusion. These were fought by the naval fire brigade and offers of assistance by the Norfolk Fire Department were declined. No official information is available as to the extent of the damage, but it is thought that the loss was at least $250,000 and perhaps much larger.

Sept. 20, Reading, Ohio. Multiple Occupancy. Loss: $360,000.

Fire of uncertain origin destroyed a large brick-joist building occupied by a wood and paper box factory warehouse, and miscellaneous offices. The fire had reached considerable proportions before it was discovered and the several small volunteer fire departments which were called were unable to cope with the situation. Although vertical openings in this building were partially protected, the floor areas were large and sections of the property were not cut off from one another. The property damage was estimated at $210,000, plus use and occupancy loss of about $150,000.

The Broad Street Station fire, Philadelphia, September 12, loss estimated at $250,000. Originating in an unsprinklered timbered area under the track platform, the fire was similar to the fire which occurred in the same location on June 10, 1923, except that the train shed destroyed by the previous fire had not been replaced.

the track platform, the fire was similar to the [illegible]
the previous fire had not been replaced.

Fire in the Sumter Wood Products Co., Sumter, South Carolina, October 1, caused loss of $350,000 and interrupted the operation of the woodworking plant filling government orders. The building was 87,000 sq. ft. undivided area of frame construction.

Acme.

Sept. 24, New Haven, Conn. Fur Storage. Loss: $3,000,000.

An unprotected electric drop light in contact with combustible material is believed to have been the cause of this fire, which spread through an unprotected air conditioning duct to involve three floors of the "fireproof" fur storage warehouse of the Yale Cold Storage Corp. No carbon dioxide flooding system or other automatic protection was provided. The vault area of the building was without windows and firemen were forced to break the walls with pneumatic tools in order to attack the fire. Damage to the building was relatively slight, but fire, smoke, and water damage to furs was severe. Insurance paid on damage to furs, resulting from 18,627 claims, amounted to more than $3,000,000.

International.

Diesel engines, electric generators and other valuable equipment made on war contracts were destroyed in this New York Warehouse, October 8, with a loss of $675,000. Largely of frame construction and lacking interior protection or barrier to the spread of fire, a large loss might have been expected once fire started from any cause.

Sept. 24, Ashland, Ohio. Eagle Rubber Co. Loss: $500,000.

A moderate-sized rubber products factory at work on Navy orders was destroyed and considerable other property was damaged by a fire which started when a tank car train of petroleum products was derailed as it was passing the plant. Twenty-three tank cars were wrecked and the contents of nineteen cars, consisting of gasoline and fuel oils, burned. The wreck area was afire in a matter of seconds; the flames ignited the roof and eaves of the rubber factory. Automatic sprinklers held the fire in check through the early stages, but later a fire department pumper took suction from a private yard hydrant and the available water supply was diverted to hose stream use. Only through vigorous work by firemen was a large section of the town saved, when rivers of burning gasoline spread through the streets. The loss to the rubber factory was approximately $350,000, to which must be added the value of damaged rolling stock, petroleum products, and other exposed structures.

Oct. 1, Sumter, S. C. Woodworker. Loss $350,000.

The Sumter Wood Products Co. plant, working on government orders, was severely damaged by a fire which started under a building in an unsprinklered space. The fire originated in or near a wood refuse "hog," which extended below the first floor level, and communicated to conveyors and ducts under the floor. Flames quickly involved the entire plant, which was of frame construction. Sprinklers operated, but the fire had reached such large proportions that they were overwhelmed. Aided by fire walls, the fire department finally succeeded in checking the spread of the flames. In addition to the unsprinklered space under the building, contributing factors in the extent of the loss were the large undivided area of frame construction (87,000 sq. ft.) and a weak public water supply.

Oct. 2, Moorpark, Calif. Warehouse. Loss: $1,000,000.

Fire of uncertain origin resulted in the total destruction of a frame warehouse containing some 4000 tons of grain and dried fruits and vegetables. There were unconfirmed reports that the fire started when a gasoline engine used in piling the stock burst into flames. The flames spread rapidly over the burlap sacks and the fire was beyond control before the fire department could put hose streams into action. No automatic sprinklers.

Oct. 6, Tee Lake, P. Q. Booth Lumber Co. Sawmill. Loss: $350,000.

One of the largest sawmills in eastern Canada, located about 15 miles northeast of North Bay, and five miles from the nearest settlement, was destroyed by a fire of suspicious origin. The plant, producing 100,000 feet of lumber per day, was only two years old. Irreplaceable machinery was destroyed.

Oct. 6, Penn Yan, N. Y. Comstock Canning Co. Warehouse. Loss: $300,000.

An overturned electric hot plate, used to liquefy box paste, was responsible for a fire in a cannery warehouse used for the storage of extra cans and finished products. All windows

Materials vitally needed for the making of cardboard shipping containers for military supplies were destroyed in this $650,000 warehouse fire in Pittsburgh, October 12. The wreckage of the steel work shown in this picture is convincing evidence that non-combustible construction of itself offers no assurance against fire loss.

were reported blocked by canned goods or empty cans, so that fire fighting operations were seriously hampered. The fire occurred about midnight and was well advanced by the time it was discovered by police. Firemen kept the flames from spreading to near-by structures. No automatic sprinklers.

Oct. 8, New York, N. Y. Warehouse. Loss: $675,000.

This property of the International Diesel Electric Co. was a one-story equal to four-story structure, having an area of 59,000 square feet, of which 32,000 square feet was of frame construction. The greater portion of the building was used for the storage of marble blocks and marble working machines. A center aisle was used for the storage of 22 diesel engines, together with electric generators, compressors, oil tanks, and control panels. Fire originated from an unknown cause in the frame portion of the building and destroyed this entire section, with severe damage to contents. The extent of this fire may be attributed to the excessive unbroken area, frame construction and lack of sprinkler protection.

Oct. 11, near Sydney, Nova Scotia. Naval Base. Loss: $1,000,000.

A long plank and pile jetty, part of a new Canadian Naval establishment, was destroyed and three vessels were damaged by a fire which spread unchecked underneath the jetty, feeding on floating oil and creosoted timbers. According to news accounts, the fire started during welding operations which were being carried on aboard one of the vessels moored to the jetty. It is obvious from the reported behavior of the fire that there were no fire breaks or other fire protection facilities underneath the jetty.

Oct. 12, Pittsburgh, Pa. Paper Box Factory. Loss: $650,000.

This plant consisted of the F. J. Kress Box Co. sprinklered manufacturing building and unsprinklered warehouse sections, separated by a fire wall. The fire started in a pile of balls of twine in a corner of the unsprinklered warehouse section and spread to rolls of paper despite the efforts of an employee with an extinguisher. The fire department was promptly summoned, but they could not prevent complete involvement of the warehouse section,

International.

Explosion and fire in the Easton, Pa., gas works, Oct. 24, caused a loss to the gas works of $150,000, and to surrounding property of $135,000.

although they did good work in saving several severely exposed structures. At the height of the fire there were as many as 62 hose streams in use, and several fire companies had to remain at the scene for three days. The manufacturing section was saved due to the automatic operation of fire doors in the dividing wall and due to wired glass in exposed windows. This section suffered only light water damage.

Oct. 15, near Little Rock, Ark. Army Property. Loss: $385,000.

The laundry building at Camp Robinson was destroyed by fire. Details of the construction of the building are not available, but it is reported that it had an area of about 140,000 square feet and was equipped with laundry machinery of the most modern design. No automatic sprinklers were installed. The laundry was operated for the most part by German prisoners of war. The fire started in one corner of the building and spread rapidly. The camp fire brigade fought the flames, but did not call for help from the near-by municipal fire department.

Oct. 24, Passaic, N. J. Textile Worker. Loss: $425,000.

Fire of unreported origin swept through a two-story unsprinklered brick-joist building occupied by several textile working establishments, one a manufacturer of handkerchiefs and another a textile printer. The fire had gained great headway before it was discovered by a passer-by and the fire department was obliged to concentrate its efforts on protecting surrounding property.

Oct. 24, near Spokane, Wash. Warehouse. Loss: $410,000.

Six million pounds of peas were destroyed when fire of unknown origin swept through a three-story brick and timber seed warehouse of the Morrison Seed Co. The property was located beyond the city limits, and although the Spokane Fire Department responded, there was little they could do because of lack of water. The value of the peas has been estimated at approximately $350,000.

Oct. 24, Easton, Pa. Gas Works. Loss: $285,000.

A severe explosion followed by a six-hour fire destroyed a large portion of the Eastern Gas Works, killing three men and cutting off gas service to this war industry area. The blast also damaged homes and business structures within a wide radius. The cause of the explosion, which is reported to have occurred in a pump and compressor room adjacent to a large auxiliary gasometer, was not determined. Damage to the gas works amounted to $150,000, and to the surrounding property $135,000.

Acme.

A series of forest fires in Southern California, starting on Nov. 6, swept over some 150,000 acres and burned 200 homes with a loss estimated at $2,000,000 or more.

Nov. 6, Southern California. Forest and Brush Fires. Loss: $2,000,000.

A series of about five major and seventy-five minor forest and brush fires swept over some 150,000 acres of Southern California, burning for several days. As many as 200 homes, both large and small, were destroyed. The loss given above is only estimated and it is quite likely that the actual loss may be much greater. In October, 1942, in the same area some 6000 acres of watershed and sixty-five structures were destroyed by a forest fire and the loss in that case was established at $1,627,000.

Nov. 6, Canonsburg, Pa. Aluminum Co. of America. Loss: $350,000.

This plant, owned by the Defense Plant Corp. (U. S. Government agency) and operated by the Aluminum Co. of America, was under construction, utilizing an existing building 110 ft. wide by 1015 ft. long without subdividing fire walls. The building was constructed of asbestos protected steel and corrugated steel on steel frame. During the construction period temporary structures of frame and celotex about 5000 sq. ft. in area had been erected within this building to house large offices, machine shop, motor generator room and electric and pipe shops. Automatic sprinklers were not provided for the main building because the final occupancy was to be non-combustible. The temporary structures had no adequate fire protection. It was reported that the Aluminum Co. of America experienced difficulty in securing authority from the government for the installation of water mains, sprinklers and fire alarm equipment. The fire originated in one of the temporary frame structures supposedly due to defective electrical equipment or wiring, or overfusing of the electric water heater circuit. Before the fire trouble had been experienced with an electric water heater. Starting in the early morning, the fire spread rapidly through the chemical laboratory where the hot water heater was located, feeding on alcohol and various chemicals. The laboratory had been unattended except for guard patrols for some time. The fire was discovered by employees, who called the plant fire brigade and attacked the fire with hand extinguishers and hose connections in the vicinity. The Canonsburg and Houston fire departments responded to the alarm and the fire was extinguished in about an hour. The temporary frame structures were completely destroyed with most of their valuable contents. The heat so softened the steel framework of the parent building that about 30,000 sq. ft. of the building collapsed.

Nov. 6, Graceville, Fla. Peanut Warehouse. Loss: $800,000.

Fire of undetermined origin occurred in a large frame peanut storage warehouse of the Greenwood Products Co., spread rapidly to the detached five-story frame peanut shelling plant, and destroyed both buildings and their contents. Salvage from the 4958 tons of unshelled peanuts was considerable. Seven freight cars, two of them loaded with shelled peanuts, were also destroyed or severely damaged. The plant was built early in 1942 and was entirely of frame construction without automatic sprinkler protection. The fire started at the top of the penthouse containing two elevator heads and spread throughout the length of the monitor. An attempt was made to fight the fire with hose streams from two private hydrants, but due to height of building, insufficient pressure, and the headway the fire had gained, these efforts proved futile. Fire departments from near-by towns and an Army Air Base concentrated on saving the office building.

Nov. 6, Camp Borden, Ont. Army Property. Loss: $2,000,000.

Fire destroyed this Canadian ordnance workshop with a loss estimated at from $2,000,000 to $5,000,000. This large loss may presumably be explained by a large amount of valuable equipment housed in a large building of combustible construction lacking adequate fire protection, but no details have been released by the Canadian military authorities, and no information is available through usual channels, as no municipal fire department was called, and there is no report that any insurance was involved. Within a month after this fire, two more fires occurred in RCAF hangars at this Camp, causing serious damage.

Nov. 8, Oakland, Calif. Army Warehouse. Loss: $500,000.

Fire in an Army warehouse destroyed a large stock of new tires and quantities of military equipment, with a loss estimated by newspapers at $500,000. The Oakland Fire Department was delayed in responding because the first alarm was turned in to the San Leandro Fire Department. One fireman was killed. No further details are available as the Office of the Commanding General, Headquarters 9th Service Command, has declined to release information. The fire department was requested by the Army to make no report and newspaper men were ordered off the grounds during the fire.

Nov. 10, Chicago, Ill. Group Fire. Loss: $325,000.

Fire which originated in the basement of a vacant seven-story brick-joisted building, spread to several adjacent and near-by buildings, at least two of which were of fire-resistive construction. The cause of the fire is not known, but it was well advanced before discovery by a passer-by. Flames spread upward through unprotected stair, elevator, and light shafts. Fire department found the building heavily charged with smoke, and when the windows and doors were opened, fire blew out and enveloped the entire structure. Fire communicated across a street 66 feet wide to a 12-story fire-resistive building and across a 50-foot vacant lot to a 22-story fire-resistive building. The fire was fought by 25 engine companies, a 10,000 g.p.m. fire boat, and 10 special equipment companies.

Nov. 11, Temple, Texas. Cotton Warehouse. Loss: $525,000.

Fire believed due to a "fire packed" cotton bale resulted in the destruction of some 4000 bales of cotton, comprising the contents of one section of a compress and warehouse. The fire occurred in a storage section 255 x 320 ft., far too large for effective control by hose streams. No automatic sprinklers. The fire was discovered in its incipiency by a clerk, who promptly called the fire department. Despite their immediate response, the fire spread rapidly due to a high wind. Fire walls confined the fire to the section of origin.

Nov. 13, Madison, Wis. Army Property. Loss: $500,000.

A large frame building at Truax Field, consisting of a central corridor with five wings, and occupying an area of about 100,000 square feet, was destroyed by a fire of unreported origin. The building was occupied as a radio school of the Army Air Forces. The Headquarters Technical School of the Army Air Forces Technical Training Command has declined to give information on this fire.

Nov. 14, Calgro, Calif. Winery. Loss: $2,225,000.

This fire, cause unknown, involved the main winery building, which was of adobe and concrete, with wood roof and a battery of eight reinforced concrete wine tanks. The fire originated in the vicinity of the office and spread rapidly through open fire doors and over unparapeted division walls. There was no city fire protection and private protection consisted of a weak water supply with fair distribution of hydrants and hose. Fifteen minutes after the watchman discovered the fire a 200 g.p.m. pumper responded from a near-by community and they were followed by two pumpers from other villages. Destruction of wood tanks in the winery building was complete and there was heavy loss of wine.

The burning of an Army warehouse in Oakland, Calif., November 8. The Army has declined to release information and no details are available as to the cause of the fire or the reasons for its spread to the proportions shown in this picture.

International.

This Atlantic City boardwalk fire, December 4, destroyed seven buildings with an aggregate loss of $480,000.

Dec. 4, Atlantic City, N. J. Group Fire. Loss: $480,000.

A fireman was killed and seven frame and brick-joisted buildings were destroyed in a fire which swept through a section of Atlantic City's famed Boardwalk. The buildings were occupied as shops, bathhouses, and apartments. The fire was discovered during the late evening by the Coast Guard patrol. First responding fire companies found one building a mass of flames, which spread rapidly to adjacent structures. The fire department was aided by the local Coast Guard unit and is credited with an excellent job in having prevented the further spread of this fire in view of the highly combustible construction.

Dec. 9, Gulfport, Miss. Phoenix Naval Stores Co. Loss: $255,000.

Nine men were killed in an explosion and fire that destroyed a plant engaged in the extraction of rosin, turpentine and pine oil from pine stumps. From the incomplete reports available, it appears that the explosion occurred in a large extraction tank containing five tons of wood chips and a large quantity of solvent. This tank was blown from the building a considerable distance and the highly flammable extract was distributed over a wide area.

Dec. 15, near Dallas, Texas. Magnesium Bomb Plant. Loss: $550,000.

This plant had been built by the Austin Bridge Co. especially for the manufacture of magnesium incendiary bomb casings. It might be assumed that anyone would know that magnesium incendiary bomb cases will burn, and that a plant designed for their manufacture would be constructed with due consideration to fire hazard. But this was not the case, hard as it may be to believe in the light of air raid warden training and general public education on the hazard of magnesium incendiary bombs. The fire started at 8 P.M. in a foundry section of a building 27,000 square feet in area, of part steel and part wood construction, with wooden subdividing walls. After the building was completed, it was found necessary to install ventilating equipment to remove fumes. Priority restrictions prevented the use of a metal duct, so a plywood ventilating duct was installed under the roof, with branches extending to within 18 inches above molds heated by gas flames. The duct caught fire from a spark or gas flame, and then it was too late to do much about it, for any water or chemical extinguisher stream, falling on hot magnesium, might have caused an explosion. It is said that some glass bottle carbon tetrachloride hand grenades were used on the burning duct, but they were ineffective, as might have been expected. The magnesium ignited, and a large quantity in storage burned furiously (see Frontispiece). The plant was outside the city limits, so the Dallas Fire Department could not respond until they received proper authorization. They did good work in preventing the spread of fire to other buildings. Even if they had been able to respond instantly, nothing could have been done to save the build-

ing after the fire started. The magnesium could have been used to start fires in enemy cities, instead of lighting the business section of Dallas, five miles away, with the brightness of noonday sun. However, in reports reaching the N.F.P.A. Executive Office, there is nothing to indicate that any effective action was taken by the operating company, by the Chemical Warfare Service of the U. S. Army, by the Defense Plant Corporation (U. S. Government agency), or by the War Production Board, though it should have been obvious that the plant was built to burn. The Austin Bridge Co., which is reported to have had no previous experience in magnesium manufacturing, suffered a costly lesson, as their loss on the building, reported at $100,000, was not insured. The U. S. Government loss, also not insured, is estimated at from $450,000 to $550,000.

Dec. 16, Waukegan, Ill. Hein Department Store. Loss: $350,000.

The buildings involved in this fire were four communicating brick-joist buildings two and three stories in height, separated by fire walls with approved fire doors, though maintenance of fire doors was poor. After the fire one door was found partly open. There were no automatic sprinklers. The basement and first and second floors were occupied by a general merchandise store and the upper floor occupied as dwelling and club rooms. Fire was discovered in the basement by a janitor, who believed he extinguished the flames with a pail of water and then left the premises. Fifteen minutes later when he returned the first floor was involved. By the time the fire department arrived the fire had burned through the roof.

Dec. 22, Shelbyville, Ill. Metal Worker. Loss: $350,000.

Three contiguous brick-joist buildings of the Ann Arbor Machinery Co. were destroyed by a fire which is believed to have been due to spontaneous ignition. The plant was engaged in the manufacture of hay balers and other machinery. During the evening, while the plant was not in operation, fire was discovered in the paint room by a repairman. He and the watchman fought the blaze for some ten minutes before calling the fire department. By the time the fire department could get into action two of the three buildings were already involved. Aided by a fire wall the firemen were able to save one building, connected to the other by a passageway.

Dec. 25, Wildwood, N. J. Conflagration. Loss: $1,000,000.

Twenty-eight mercantile properties, two hotels and several dwellings were destroyed early on Christmas morning in a conflagration which also took two lives. The fire is believed to have been due to a faulty gas heater in the watchman's room on a pier which supported a number of the properties destroyed. A strong wind was blowing off the ocean, fanning the flames and driving them shoreward through one frame structure after another. From the information received it appears that the pier was protected by a wet-pipe sprinkler system, which was shut off and drained for the winter and was therefore not a factor in the fire.

Dec. 25, Dallas, Texas. Cotton Warehouse. Loss: $600,000.

Fifty-five hundred bales of cotton were destroyed in a fire which swept through a section of a cotton warehouse. At the time of going to press we had not received further details.

Wildwood, N. J., Conflagration, Dec. 25, 1943.

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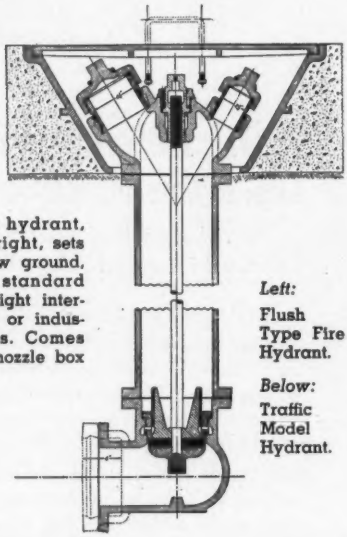

Flush type fire hydrant, illustrated at right, sets completely below ground, is used where standard type hydrant might interfere with traffic or industrial operations. Comes with cast iron nozzle box and cover.

Left: Flush Type Fire Hydrant.

Below: Traffic Model Hydrant.

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DuGas, well known for its fast action in extinguishing difficult fires, now makes an important new contribution to fire protection. Research has resulted in the development of a new PLUS-FIFTY duGas Dry Chemical with increased fire-fighting effectiveness when applied from duGas pressure-type dry chemical extinguishers. This new, faster action is obtained without sacrificing any of the advantages of the former duGas.

APPROVED by the Underwriters' Laboratories and the Factory Mutual Laboratories.

AVAILABLE in Models 15 and 30 Hand Extinguishers, Models 150 and 350 Wheeled Extinguishers.

...WRITE FOR COMPLETE BULLETIN ON NEW PLUS-FIFTY DUGAS and Priority Information on Extinguishing Equipment.

Proven by Hundreds of Practical Fire Tests

It retains the long-range effectiveness of the stream which permits the operator to knock down fire from a greater distance. It hangs in a cloud over the fire, providing greater smothering action and reducing flashbacks. Like the former duGas, PLUS-FIFTY duGas will not cake, harden, evaporate, deteriorate or freeze. It generates no toxic fumes and is not an electrical conductor. Since no critical materials are used in its production, PLUS-FIFTY duGas is available without priority for refill purposes...and there is no advance in price.

Model 150
Wheeled Extinguisher

WRITE FOR
Chart showing characteristics of *all* types of approved hand fire extinguishers.

[redacted]

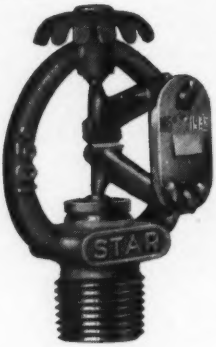
GUNS!

BULLETS!

SPRINKLERS!

Vital Wartime Essentials! Star Automatic Sprinklers defeat the saboteur, whose chief weapon is fire — Combat our enemies by guaranteeing uninterrupted war production — Preserve critical materials for our armed forces — Protect the assets of our Nation!

Automatic Sprinklers
Corrosion-proof Sprinklers
Directional Flow Sprinklers
Open Sprinklers
Ornamental Sprinklers
Alarm Devices



Automatic Releases
Alarm Valve (Wet) Systems
Dry Pipe Valve Systems
Deluge Systems
Heat-Actuating Devices
Pre-Action Systems

Star Automatic Sprinklers and Fire Protection Devices bear approval of all Insurance Authorities having jurisdiction and various Governmental Agencies.

Economy in installation cost and maintenance has dictated the consistent policy of Star Sprinkler Corporation in distributing its Fire Protection Devices through local licensed contractors who have had a lifetime of experience in the installation of automatic sprinkler systems. Operating throughout the United States, Canada and South America, Star licensees, due to their strategic locations, can render instant service. Write us for name and address of Star licensed contractor nearest your location.

STAR SPRINKLER CORP.

Westmoreland and Collins Sts. - Philadelphia, Pa.

Oil-drenched and salt-encrusted,

PYRANOL TRANSFORMERS COME THROUGH UNHARMED

Three Pyranol transformers were in operation on a large tanker when it was torpedoed off the Atlantic coast. For days they lay submerged in oil and salt water, until what was left of the tanker was salvaged. When the ship finally reached dry dock, the transformers were tested and found to be in as good working condition as the day they were installed.*

IT'S HARD to find an application where Pyranol transformers won't fill the bill. The high dielectric strength which they have in common with other liquid-filled transformers makes it easy for them to withstand the effects of lightning and of voltage surges from switching operations.

Install Pyranol Transformers Right Where You Need Them

You can install Pyranol transformers underground, on an overhead platform, on the roof, on the factory floor, indoors or outdoors. The pressure-tight tank protects vital parts from the effects of dust, dirt, and atmospheric moisture—as well as from oil and salt water.

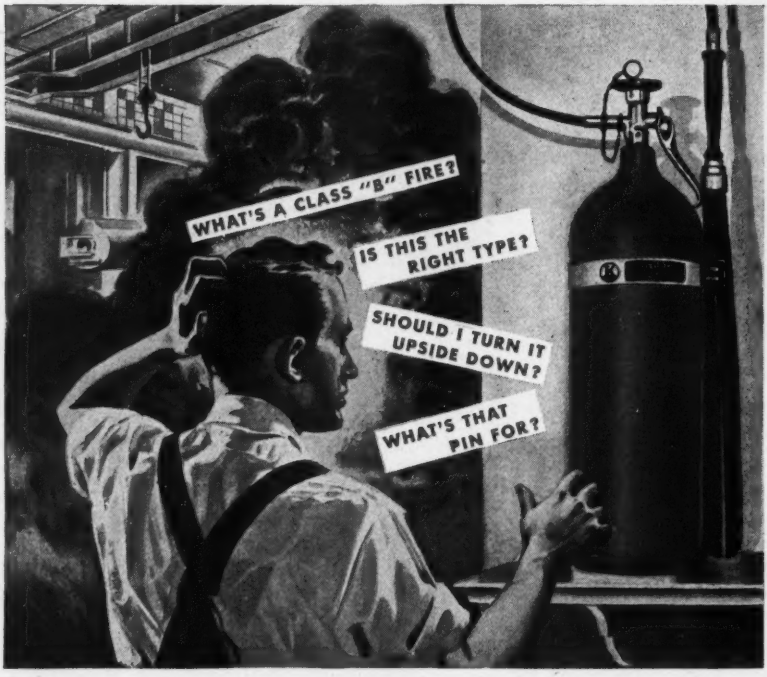
Maintenance Cost Is Low

Pyranol, the synthetic, noninflammable insulating and cooling liquid, is nonsludging—maintenance is negligible. Tests show that the Pyranol in the first transformers of this type, installed more than ten years ago, is still in its original condition.

For further information call your G-E representative today. He'll be glad to help you. *General Electric, Schenectady, N. Y.*

**Reg. U.S. Pat. Off.*

GENERAL ELECTRIC



Give him the answers before it's too late!

● When fire breaks out at your plant, will the confusion of your men give the blaze time to get out of control? Not if they've been shown exactly what to do. Men *who know how* act swiftly and confidently to nip small fires.

Make sure your key men have the training they need. Stage a demonstration now.

To help you plan an interesting show, Walter Kidde & Company has issued a booklet, "HOW TO TEACH FIRE FIGHTING." Write for your free copy today.

WALTER KIDDE & COMPANY, INC., 135 MAIN STREET, BELLEVILLE, N. J.

The Future

RESTS ON PLANNING

● **He who builds a house without plans and specifications is headed for trouble. He may be able to muddle through and finish the job, but the finished product does not conceal the lack of plans. More than ever before, the production, refining and transportation of petroleum and its products requires careful, long range planning. ☆We will be glad to assist you in those phases of your plans which pertain to the storage, transfer, measurement, fire safety and conservation of petroleum and its gases.**

SHAND & JURS CO.

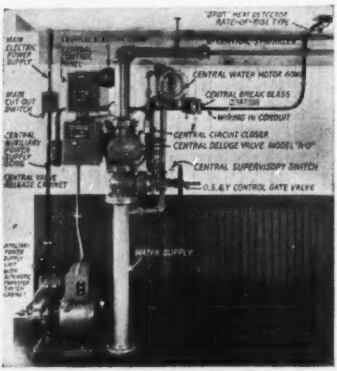
BERKELEY, CALIFORNIA

NEW YORK CHICAGO HOUSTON LOS ANGELES SEATTLE

SHAND & JURS

There is always the One Best

Central "Electro-Speed" Deluge Sprinkler System Model "AD"



Completely Electrically Operated

• • •

Rate of Rise and Fixed Temperature Controlled

• • •

Fully Supervised

"A PRODUCT OF THE ELECTRONIC AGE"

Over three years ago we pioneered the first Underwriters approved electrically operated deluge type automatic sprinkler system. We now present, in the CENTRAL Model "AD" Electro-Speed Sprinkler System, a completely new and all electrically operated system, amazing in its simplicity of design and in its instantaneous super-speed electric operation.

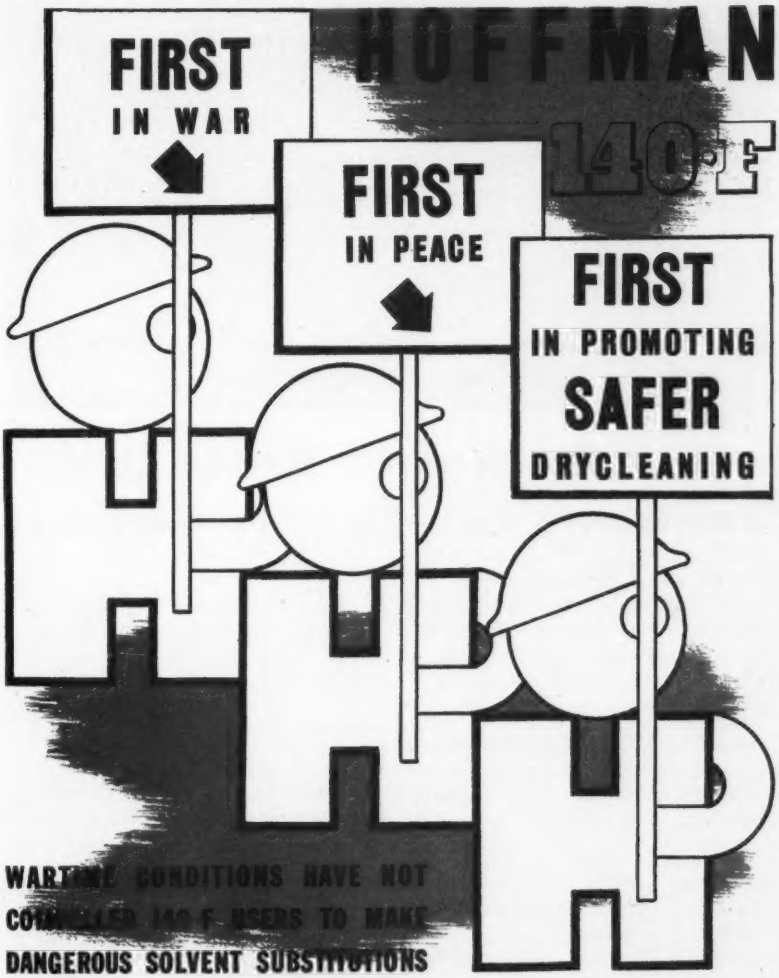
Every functional part is a standard product with years of dependable use to insure for you satisfactory and continued service.

Already over one hundred CENTRAL Model "AD" Deluge Sprinkler Systems are now in service protecting vital United States Army and Navy, and privately owned properties, and proving their superior design and operation over older types of deluge systems in adjacent buildings in some of these properties.

Send for illustrated and descriptive bulletin N.P.-V-4.

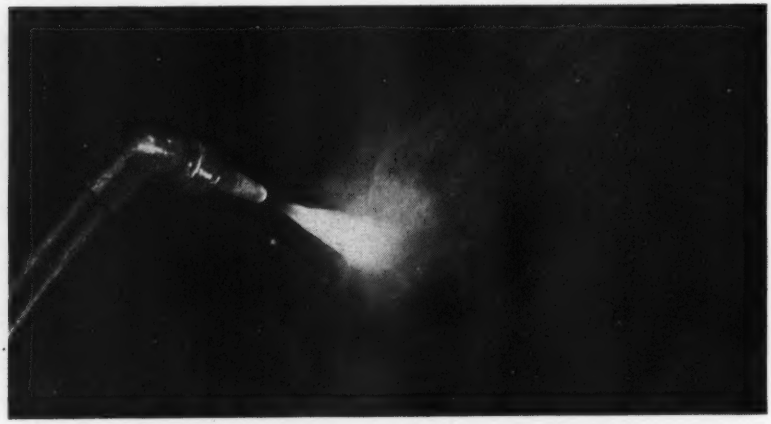
CENTRAL AUTOMATIC SPRINKLER CO.

241 EAST ASHMEAD STREET . . PHILADELPHIA, PA.



Drycleaners using Hoffman 140-F Safety Petroleum Solvent Drycleaning Systems are still able to continue their legitimate operations—using 140-F Class II machinery with listed high flash petroleum solvents. Unlike users of some other types of machinery they have not been compelled by war shortages to use these solvents in equipment not designed for petroleum solvent operation.

U. S. HOFFMAN MACHINERY CORPORATION
105 Fourth Ave., New York 3, N.Y.
DRY CLEANING LAUNDRY & GARMENT PRESSING EQUIPMENT



It Welds Steel . . .
Yet Won't Ignite This Canvas!

This actual, unretouched photograph of a white-hot oxyacetylene torch flame billowing off a FIRE CHIEF Canvas welding curtain, tells more than a thousand words. Yet fire resistance is only part of the story.

This HOOPERWOOD "Engineered Canvas" is equally resistant to water, weather and mildew, greatly lengthening its life in service.

"Canvas Engineering" is opening up new broad fields of usefulness — offering advantages many products will benefit from when the peace is won and our entire production is no longer required by the armed forces.

To mention but a few — awnings that won't ignite from carelessly tossed cigarettes or rot from mildew — special canvas truck covers that will outlast their predecessors several times over — canvas marine supplies that will help strike out the fear of fire on shipboard — aircraft canvas fabrics that repel gasoline and oil.

These and many other applications of "HOOPERWOOD - Engineered" fabrics for Business and Industry will be waiting for you when conditions return to normal.

WM. E. HOOPER & SONS CO.
New York PHILADELPHIA Chicago
Mills: WOODBERRY, BALTIMORE, MD.

•

Since 1800 (through six wars) the HOOPER name has symbolized highest quality in Cotton Duck and other Heavy Cotton Fabrics, Paper Mill Dryer Felts, Filter Cloth, Rope, Sash Cord.

• *Fire-Chief Finished* •

HOOPERWOOD COTTON DUCK

HOW "Automatic" FIRE-FOG WORKS

The way "Automatic" FIRE-FOG goes into action, when oil or other flammable liquid ignites, amazes—and re-assures—those who have seen it perform. In a matter of seconds this is what FIRE-FOG does:

A mist-fine water spray automatically blankets and chokes the fire. FIRE-FOG Nozzles, properly placed and directed at time of installation, assure the complete spraying of the fire area.

The cooling spray that so thoroughly encircles the fire, produces a "ring of isolation." Thus, the fire is confined and the danger of spreading is reduced to a minimum.

With FIRE-FOG actively and relentlessly spraying every square inch of burning surface, the flames are brought under control almost immediately and the fire is quickly quenched.

This, briefly, is the story of "Automatic" FIRE-FOG in action. The details of this outstanding system of fire protection should be *must* information for every executive concerned with fire protective measures. An "Automatic" engineer will be glad to call—no obligation, of course.

TEST IT—PROVE IT! At "Automatic's" Proving Ground in Youngstown, Ohio, full scale fires, using a quantity of your own flammable liquid, will determine the kind of fire quenching system you need. Your fire hazard conditions are reproduced, fires are started, experiments are made. ***Guess-work is eliminated.***

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA ★ YOUNGSTOWN, OHIO

★ ★ ★ OFFICES IN PRINCIPAL CITIES ★ ★ ★

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA — RATE OF RISE — TRADE MARK REG. U.S. PAT. OFF.

VIKING

INDUSTRIAL SPRINKLING SYSTEMS *on guard!*

Viking Sprinkler Systems guarding vital War Bases and Plants say "Not Here" to Fire! Today, Viking's entire output is going where the tools of war are made, stored, handled, repaired and used.

Thus in war, as in peace, Viking Sprinkler Systems are proving their dependability. When Viking stands guard, Fire heeds the command "Not Here!" . . . and the tools of war stay fit for their intended job.

VIKING CORPORATION DEALERS

Crawford & Slaten Co.
Atlanta, Georgia
C. W. Hutchinson, Inc.
Huntington, W. Va.
Indiana Automatic Sprinkler Co.
Indianapolis, Indiana
Texas Automatic Sprinkler Co.
Dallas, Texas
Walton Viking Company
Kansas City, Mo.
Viking Automatic Sprinkler Co.
Boston, Mass.
Viking Automatic Sprinklers, Inc.
Buffalo, New York
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Los Angeles, California
Viking Sprinkler Co.
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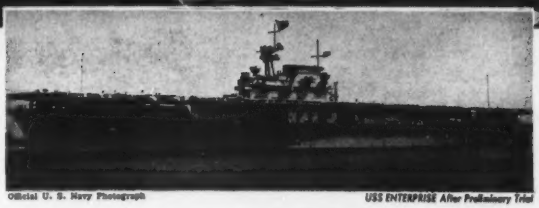
Viking Automatic Sprinklers, Ltd., Toronto, Ontario, Canada
Viking Automatic Sprinkler Co., San Francisco, California

THE VIKING CORPORATION
HASTINGS, MICHIGAN

Official U. S. Navy Photograph

Action in the battle of Santa Cruz, October 26th. A Jap bomb splashes astern the USS ENTERPRISE. The stormy sky is black flecked with anti-aircraft bursts.



Official U. S. Navy Photograph

USS ENTERPRISE After Preliminary Trial

"Your Foam Fighting Equipment **contributed** to the brilliant record of the USS ENTERPRISE, number one fighting ship of the fleet"

"During the Marshall Island raid, gasoline fires started on the flight and hangar decks by a Jap bomb hit were extinguished . . . by your equipment. Speedy control of these fires enabled the 'ENTERPRISE' to stay triumphantly afloat and fighting throughout her long and victorious campaign."

The above quotations are from a telegram recently received from the U. S. Navy Department.

In addition, National Fire Foams have been adopted and are being used extensively by most oil refineries and large industrial plants.

IN FIRE DEPARTMENT SERVICE

National Foam System has equipment especially designed for the use of Fire Departments to meet all types of fire fighting requirements. Complete engineering service available.

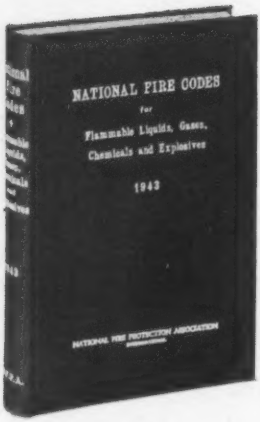
The experience of our engineering department is at your service.

NATIONAL FOAM SYSTEM, INC.

Specializing in Foam Fire Protection

1632 Sansom St., Philadelphia, Pa.

Announcing



NATIONAL FIRE CODES
for
FLAMMABLE LIQUIDS, GASES, CHEMICALS AND EXPLOSIVES

This 500-page volume brings together for convenient reference the many standards dealing with flammable liquids, gases, chemicals and explosives. The number and diversity of these standards has become so great that it is increasingly difficult for the average user, who is interested in a wide variety of subjects, to keep track of all the standards in separate small pamphlet form.

Price $3.00 POSTPAID

Indispensable for fire chiefs and other fire department officers; fire marshals; fire inspectors; firemen; consulting engineers; building commissioners and inspectors; various other state and local administrative authorities; industrial fire protection and safety engineers; industrial executives; technologists in petroleum, gas, and chemical industries; insurance companies, engineers and inspectors; state, local, and special insurance agents and brokers; universities; libraries, etc.

Place Your Order Now!

NATIONAL FIRE PROTECTION ASSOCIATION
INTERNATIONAL
60 Batterymarch St., Boston 10, Mass.

The SQUEEZ-GRIP valve is a development so sensational, and of such great importance, that it actually changes the idea of what constitutes speed in fire fighting. It ends the delay, the waste motion of setting down an extinguisher to operate a "hand-wheel" valve.

NEW SQUEEZ-GRIP SAVES TIME AND GAS

With this new C-O-TWO release valve the operator merely closes his hand to operate the release lever, just above the carrying handle, and carbon dioxide gas, the fastest non-damaging fire extinguishing agent, is released against the fire in split seconds. Time is saved . . . gas is saved. Even while carrying a fifteen pound extinguisher, C-O-TWO gas can be discharged and shut off as quickly as the hand is closed and opened. The New SQUEEZ-GRIP is the most modern contribution to fire protection. It's Safer because It's Faster.

C-O-TWO is a registered trademark and corporate name of this company. C-O-TWO is inspected and labeled by the Underwriters' Laboratories; approved by Factory Mutuals and the Bureau of Marine Inspection and Navigation. To be safe specify C-O-TWO.

C-O-TWO FIRE EQUIPMENT COMPANY

NEWARK 1 NEW JERSEY

Sales and Service in the Principal Cities of United States and Canada

AS ON THE WELL-HANDLED

BATTLESHIP

Industry provided with

GLOBE AUTOMATIC SPRINKLER PROTECTION

has in each well-placed

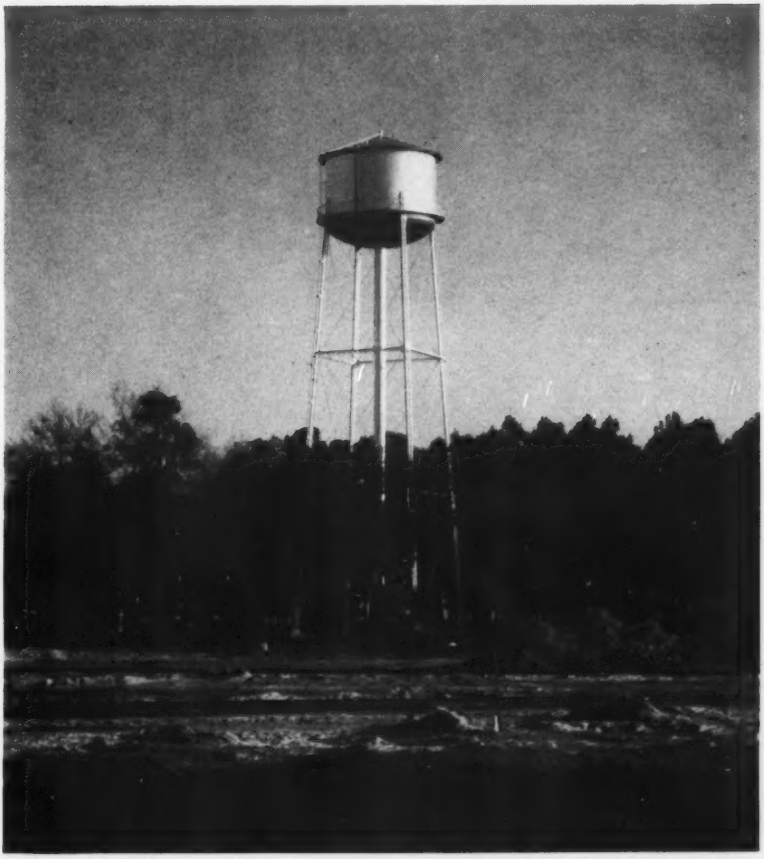
SPRINKLER

An Ever Watchful LOOKOUT
alert for the first sign of danger
to flash an Alarm
A Trained Fighter at Every BATTLE STATION
on duty
DAY AND NIGHT — ALWAYS

Far out ahead, is the advance design line of approved GLOBE SPRINKLER APPARATUS for AUTOMATIC FIRE EXTINGUISHMENT — the result of nearly 50 years' research and development.

GLOBE devices embody the maximum of engineering ingenuity with a minimum of critical materials. They are approved by all government and insurance authorities. They are essential during the war and the post-war era.

GLOBE
Automatic Sprinkler Co.
2035 WASHINGTON AVENUE
Philadelphia, Pa.
SALES OFFICES IN PRINCIPAL CITIES



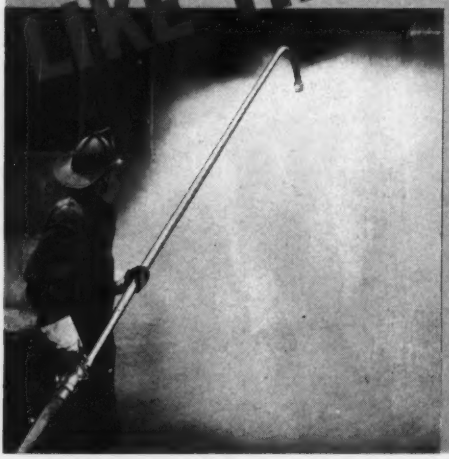
Guarding Against Further Shortage

The shortage of paper is beginning to be felt throughout all industry. A disastrous fire in one of our paper mills would cut an inadequate production seriously. At many paper mills, elevated water tanks like this 100,000-gal. installation are guarding against catastrophe by providing gravity water pressure for automatic sprinkler systems.

CHICAGO BRIDGE & IRON COMPANY

CLEVELAND CHICAGO BIRMINGHAM NEW YORK
WASHINGTON HAVANA GREENVILLE, PA. PHILADELPHIA
HOUSTON HILLSIDE, N. J. TULSA SAN FRANCISCO

WATER LIKE THIS FIGHTS OIL FIRES SUCCESSFULLY



EVEN WHERE WATER LIKE THIS FAILS

Break water — your cheapest, most plentiful fire-fighter — into tiny particles smaller than spray . . . and you have WaterFOG — your cheapest *and* best extinguisher of oil fires!

You wouldn't play a *stream* of water on a flammable liquid fire—even *spray* is often not effective. But gentle WaterFOG sponges up heat so much faster . . . that many firms have given up other more expensive, less certain methods to return to *water*.

WaterFOG's success is due to water's cooling power being proportional to total surface exposed to heat. WaterFOG presents far more surface to the fire—and for a longer time (due to its lightness) than an equal quantity of water in any other form.

WaterFOG first quenches the flames. Then, floating over the liquid, it cools that, too, retarding further vaporization. Finally, changing into steam, it smothers the fire, cutting off flame-feeding oxygen. All without spreading or agitating the fire! Less water is needed, saving water damage. "Flashback" is prevented. And WaterFOG is safe on electrical fires. Write today for Bulletin 123.

WaterFOG is created by impinging streams from specially-designed Rockwood nozzles—engineered in correct particle size, fog pattern, and velocity for your conditions. Fixed piping installations, hose nozzles and applicators. Rockwood installations approved by Underwriters' Laboratories and Associated Factory Mutuals; used by Navy, Coast Guard, hundreds of industrial plants. EXECUTIVES! colored movie (16 mm.) showing tests of Rockwood WaterFOG, is available.

ROCKWOOD SPRINKLER COMPANY

56 Harlow Street, Worcester, Mass.

Specialists in Fire Protection Engineering, Equipment and Installation since 1907

ROCKWOOD WaterFOG

WATER, ENGINEERED BY ROCKWOOD, COOLS, CONFINES, SMOTHERS OIL FIRES

WHERE IS THE NEAREST FIRE ALARM BOX?

for FIRE
USE THE NEAREST BOX
NO.
AT
and wait for the Firemen
DO YOU KNOW THAT
600,000
fires occur annually in the U.S.A.
10,000
human lives are lost and
100,000
others are seriously injured and
$400,000,000
in property values plus the indirect losses creating a total waste in excess of One Billion dollars are annually destroyed by Fire
70%
of the fires — and life losses occur in dwellings.
43%
of the commercial establishments destroyed do not rebuild, and the community loses prestige, business, payrolls, taxes and wealth.
50
times its original size is the spread of fire within 8 minutes after inception.
WHEN FIRE OCCURS—
Use the Box IMMEDIATELY
Delayed Alarms are largely responsible for the excessive Fire Loss.
The Box Is Your Best Protection
FIRE DEPARTMENT

INSTRUCTION CARDS

PROMINENTLY DISPLAYED

in every building will inspire "fire consciousness" and proper action when fire occurs. Fire signaling facilities were never more urgently needed, but scarcity of materials necessitates greater dependence upon existing boxes. Their prompt use for fire will conserve national resources.

THE GAMEWELL COMPANY

NEWTON UPPER FALLS, MASSACHUSETTS

That Second . . . FRONT!

The second a fire starts in any building protected by a Grinnell Automatic Sprinkler System, there is a Grinnell Sprinkler up front, ready to extinguish it immediately. On silent duty, day and night, year after year, it is standing guard to quench a fire at its start.

Dependable, automatic, Grinnell Sprinklers detect and put out fire from any origin before major damage can occur. They have extinguished over 8000 fires in the past ten years.

A Grinnell Automatic Sprinkler System is engineered and prefabricated to meet your special requirements . . . then installed with minimum disruption to occupancy routine. There is a type of System for every fire hazard — each designed to provide the utmost in automatic fire protection. Complete information is available for the asking from any of our offices throughout the country. Grinnell Company, Inc., Providence 1, Rhode Island.

GRINNELL

AUTOMATIC SPRINKLER FIRE PROTECTION